



FRIDAY, MARCH 16, 1894.

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Contributions.

Switch Lights.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with interest the statement in your issue of Feb. 16 concerning the use of colors in switch lights on certain Chicago railroads. I think your comments are exactly to the point, and you might have gone farther. The four-sided switch light ought to be discarded. There is no reason for having a light on the back side of a switch, and every additional light helps to confuse enginemen and conductors, especially if it is a white light. On main tracks, switch lights are a nuisance at best. Every switch should be guarded by semaphore signals and the semaphore should be located at the clearing point for trailing point switches and in advance of the switch rail on facing point switches. Signal engineers can do nothing better to advance safety and good practice on our railroads than to devise the cheapest and simplest apparatus for doing this.

D. M. C.

Safety in Car Lighting.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of March 9 appears a letter from W. C. P. under the above title which is calculated to give a false idea of what is now an almost absolutely perfect system of lighting. In fact the occurrence related could not possibly take place on a car that has been equipped with Pintsch apparatus at any time during the last 10 years. In the case referred to the gage for indicating the pressure of the gas in the tanks was placed in the closet and connected to the tanks by a copper pipe $\frac{1}{4}$ in. outside diameter. This pipe became broken. There is a report, which, however, lacks positive confirmation, that this was done by an intoxicated man. At any rate, the compressed gas escaped into the closet, and was lighted by the oil lamp in the closet. The present application of Pintsch equipment arranges all gas while under compression, outside of and near the middle of the car.

The Pintsch light, which is beyond the experimental stage, having been in use for many years, is now daily demonstrating its safety and superiority, being used as the illumination on more than 55,000 cars. Experience would seem to have established that it is an eminently safe system, approaching nearly to perfection. It is difficult to find a single feature of the system which might prove a source of danger, even under the most rare combination of unfavorable circumstances.

GAS ENGINEER.

Who is Responsible for Weak Cars?

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read in your columns interesting articles on the relative strength of passenger cars in this country, and have been interested in some discussion in recent issues of railroad papers about who is responsible for running weak passenger cars. The superintendents with whom I have talked claim that the master car builders and the superintendents of motive power are responsible if they do not notify the manager when the coaches are so weak as to be dangerous in collisions. The master car builders and superintendents of motive power claim that they are only required to keep the coaches in repair and safe to run under normal conditions, and are not instructed to take wrecks into consideration, the management directing whether the coaches are to be run or

not. It appears to me that it cannot be expected that superintendents of railroads are sufficiently well informed in mechanical matters to know about the strength of equipment; and, on the other hand, the mechanical departments do not feel justified in recommending casting aside equipment that is serviceable and safe under normal conditions of running, neither do they want to advise the expenditure of large sums of money to strengthen the equipment. The point I hope to see discussed is: Where does the responsibility of the chiefs of the mechanical departments and of the superintendents begin and end in this matter?

OPERATOR.

[The responsibility must come back to the actual head of affairs, the President, a Vice-President or the General Manager as the case may be. It is his business to know whether or not his rolling stock is up to par. He can distribute as he chooses the responsibility of finding out and reporting the facts. The initiative should come from the top, and not from the bottom; that is what the top is for. It is quite unnecessary to discuss the nice ethical question whether or not a M. C. B. should resign if his superior officer insists on running cars that he, the M. C. B., thinks unsafe; but obviously it is his plain duty to let his superior know that they are unsafe.—EDITOR RAILROAD GAZETTE.]

Comparative Tests of Simple and Compound Locomotives.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Regarding the Long Island test, an account of which is given in your issue of Feb. 9, would it not be fair to state what the respective capacities of these engines are, and if the load hauled was about the full capacity of each engine? If not, would it be a fair test to confine both engines to the same load if one was capable of hauling much more than the other? While this might not change the figures given, they might be changed if each was given its full load.

H.
[Our correspondent will find in the *Railroad Gazette* of Feb. 9 a complete statement about the relative dimensions of the engines. The rated capacity is the same for both the compound and the simple engine. The use of the compound cylinders does not change the rated capacity. As the rated capacity is the same, it was a fair test to confine both engines to the same load. If each engine were given all the load it would haul on a level track, the limit would probably be found the same for the compound and simple engine, for the reason that the limit of hauling power would be the weight on the drivers, which is the same in both engines. On a grade with a long, hard pull, the compound would have the advantage, because the limit would then be found in the boilers, for the compound uses steam to better advantage, and it would probably haul more cars up a long and steep grade.—EDITOR RAILROAD GAZETTE.]

Why Postpone the Needed Reform in Track Superstructure?

NEW YORK, March 1, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Every reader of your paper will have been instructed and encouraged to hope for better tracks than we now have, by the practical suggestions of improvements which have been made by eminent engineers through your columns, reference being made especially to the communications of Messrs. T. C. Clarke and B. Reece and Colonel Katté. To Mr. Katté we have been indebted for many important betterments already, and all experts will heartily endorse the proposals in his latest articles for the improvement of our present system of permanent way. But why should we postpone the adoption of the continuously supported rail, as he suggests, until some period far in the future? If once the roadbed and ballast have been prepared according to Colonel Katté's specifications, it will not be reasonable to postpone its use for a single day; the sole purpose of the sleeper will have gone like Napoleon I.—"Twill have slept its last sleep; 'twill have fought its last battle," etc. A brief calculation would show that even to lay down the Herkules rail of Haarmann and Vietor (please get the printer not to set this name up Victor again) will cost only a little more than the standard 90-lb. rail, with such crossties and fastenings as Colonel Katté judiciously advocates; and if the cost of maintenance and renewals is considered, the Herkules track is the cheaper investment. It is certified to have required only \$20 per mile per annum to maintain it. Was any main track upon crossties ever maintained for less than ten times that sum? Why persist in nursing the crosstie when it will have become only a nuisance? First impregnate it with a preservative against decay; then put an armor plate upon it to prevent it from being cut into by the rails; then provide some new fastenings to hold the rails upon it, for all agree that the spike is miserably deficient; and when all these attentions have been given to all the crossties, the track laid upon them will be inferior to one without them.

The diagrams which were shown at the World's Fair by the Osnabrück manufactory demonstrated that the

vertical and horizontal movements experienced under passing trains by the rails laid upon sleepers, were enormously greater than those of the continuously supported rails of equal weight; and if this is true under the lighter rolling stock used upon the European railroads, how much better would the rail without sleepers, sustained at every point in its length, bear the shocks delivered by our ponderous locomotives than does our lighter rail supported only at intervals upon ties which are pumped up and down, are cut into deeper by every passing train, and are without any fastenings worthy of mention?

Please notice that it is not I who has described our present track, upon which the heavy lightning express trains are now running in these contemptuous terms, but your correspondents, who are in permanent way relations to this problem and know all about it.

My own object is to call attention to where American engineers are standing. We are running the fastest trains in the world and the heaviest; we need the best tracks in the world, and if there is anywhere a better system than ours we at least ought to experiment with it and find out about it for ourselves. We ought to know what a Haarmann-Vietor track will cost to maintain in this country, and how it will carry our trains; we ought to show, also, as I think, that American engineers can recognize a good thing when they see it.

CHARLES PAINE.

The Cost of Handling Cars in a Large Yard.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The design of a freight yard by Mr. Scott in the *Railroad Gazette* of Jan. 5 is unquestionably superior to most existing yards, but the force required to operate it is rather discouraging. The following is Mr. Scott's schedule of force with what may be considered fair pay for the class of men required:

Monthly men.		
General yardmaster	.....	\$125
2 assistant yardmasters, at \$90	.....	180
Total per month	.....	\$305, or per day \$10.17
Day men.		
8 engineers	.....	at \$3.50
8 firemen	.....	2.00
6 conductors	.....	2.50
42 brakemen	.....	1.60
4 cutters and polers	.....	2.50
8 switch tenders	.....	1.60
Total per day of 12 hours	.....	\$159.17

This makes the cost of switching labor alone 15.9 cents per car. I know that 1,000 cars per 24 hours can be taken from the receiving yard and distributed in nine classes in a yard not so conveniently arranged for the work as Mr. Scott's yard, by the tail-switch method, at a cost for switching labor of four cents a car. I therefore think that the work in the yard proposed can be done with less force than Mr. Scott specifies. I would suggest the following reductions in the force proposed:
(1). Take off the engines and crews to place trains on the poling tracks. Omit the poling and classification engine tracks. Arrange the classification engine to pole from the track on either side and work it on any of the receiving tracks putting in one more receiving track in order that there may always be one track clear for this purpose. This will lessen the total length of the yard nearly 1,200 ft. Incoming trains will not interfere with the classification engine in the westbound yard, as the trains are backed in and nothing crosses the switches at the east end of the receiving yard until pushed down by the poling engine. In the eastbound receiving yard the poling engine will be stopped to let incoming engines out to the roundhouse.

(2). Reduce the number of brakemen on the classification engines to 4 each. The crew is expected to distribute 500 cars per day. The heaviest cutting that has come to my attention is in coal of different grades, consigned to various points indiscriminately mixed in the train as it came from various mines. This has required 45 cuts per 100 cars, giving 225 cuts, or 56 cuts per man per day, instead of the 80 which Mr. Scott considered a fair day's work.

(3). Dispense with the switch tenders, except one at each outlet from the yard. Have the conductor of the poling crew mark the last car of each cut with the number of the classification track to which the next cut is sent and the returning brakemen can keep the switches turned for the following cuts.

(4). Dispense with the engines to pick up brakemen. Have the crew at the forward end of the classification yard keep the cars pulled down so that the distributing brakemen need not come more than 25 car lengths from the rear end of the classification tracks. If necessary, the poling engine can push the cars down.

Our yard force will now be the following:

Monthly men, as before per day	.....	\$10.17
Day men:		
4 engineers	.....	at \$3.50
4 firemen	.....	2.00
4 conductors	.....	2.50
14 brakemen	.....	1.60
4 cutters and polers	.....	2.50
2 switch tenders	.....	1.60
Total per day	.....	\$77.77

This gives the cost of switching labor nearly 7.8 cents per car, a figure more nearly in harmony with the present condition of railroad finances.

I would also suggest as a modification of Mr. Scott's yard that a track be added from the west end of the receiving yard to the east end of the classification yard and take incoming westbound trains from

the main freight track at the same point at which outgoing trains leave it, thus preventing a train that may be held out of the receiving yard from blocking all outbound movement.

E. T. REISLER.

Some Results of the Stewart Avenue Pneumatic Interlocking.

March 9, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

After several years of preliminary work on the part of Mr. E. L. Corthell, Consulting Engineer, the work of installing the Westinghouse pneumatic interlocking and signaling system at Stewart Avenue and Twenty-first street, Chicago, by the Union Switch & Signal Company, has been accomplished,* and that those interested may know the benefits to be derived from this class of interlocking and signaling, I send you a comparison between the operations by hand and the operations by this interlocking machine.

Among the advantages gained by the interlocking it may be noted that with flagmen scattered over the ground working independently for the several roads and giving all advantage possible to their employers' trains, there was necessarily much confusion and also uncertainty about getting trains over in order of their arrival and their rights. With movements all directed by one experienced man from the tower, and he being an employee of all the parties, each road receives fair and impartial treatment. Trains of conflicting roads are prevented occupying the crossing to the possible blocking of other lines.

Engineers of trains move with much more confidence and freedom under the semaphore, knowing that signals for interlocking routes are blocked. Previously, when taking hand signal from a flagman, the engineer had no assurance that another flagman was not sending some other train in front or into him. It was a common occurrence to see light engines taking obviously unsafe chances, slipping over crossings between moving trains going in opposite directions on some other company's tracks. That accidents were not more frequent appeared to an onlooker a mere matter of good luck.

All switches being now controlled from the tower and protected by semaphore, chances of derailment about the yard disappear. When some of the switches were handled by switch tenders, and others by train crews, derailments were frequent. Now trains have fewer delays on this account, and section men have fewer calls to the yard to repair broken tracks and switches.

The work of switching to and from the Indiana Elevator and the Elgin street yard of the Western Indiana road is done as expeditiously as when the flagmen protecting these movements were working wholly to the advantage of that road; the disadvantage of such protection being noticeably against the Chicago, Madison & Northern, Santa Fe and Pennsylvania Company.

With the interlocking switches there have been unloaded at the elevator 104 cars in 8 hours, which is more than had been done in the same time under the old arrangement, and this, too, without holding trains on other roads.

A marked advantage in the handling of inbound freight trains on the Pennsylvania and Western Indiana roads is the ability of towermen to direct them in such a manner as to avoid so frequent outings at Twenty-second street, and at Archer avenue, and consequently trouble with city policemen on these streets. When signaled to come ahead the towerman can always insure their passage without being held again and out. This applies in a measure to inbound trains on other roads at Twenty-second street, but not in so marked a degree.

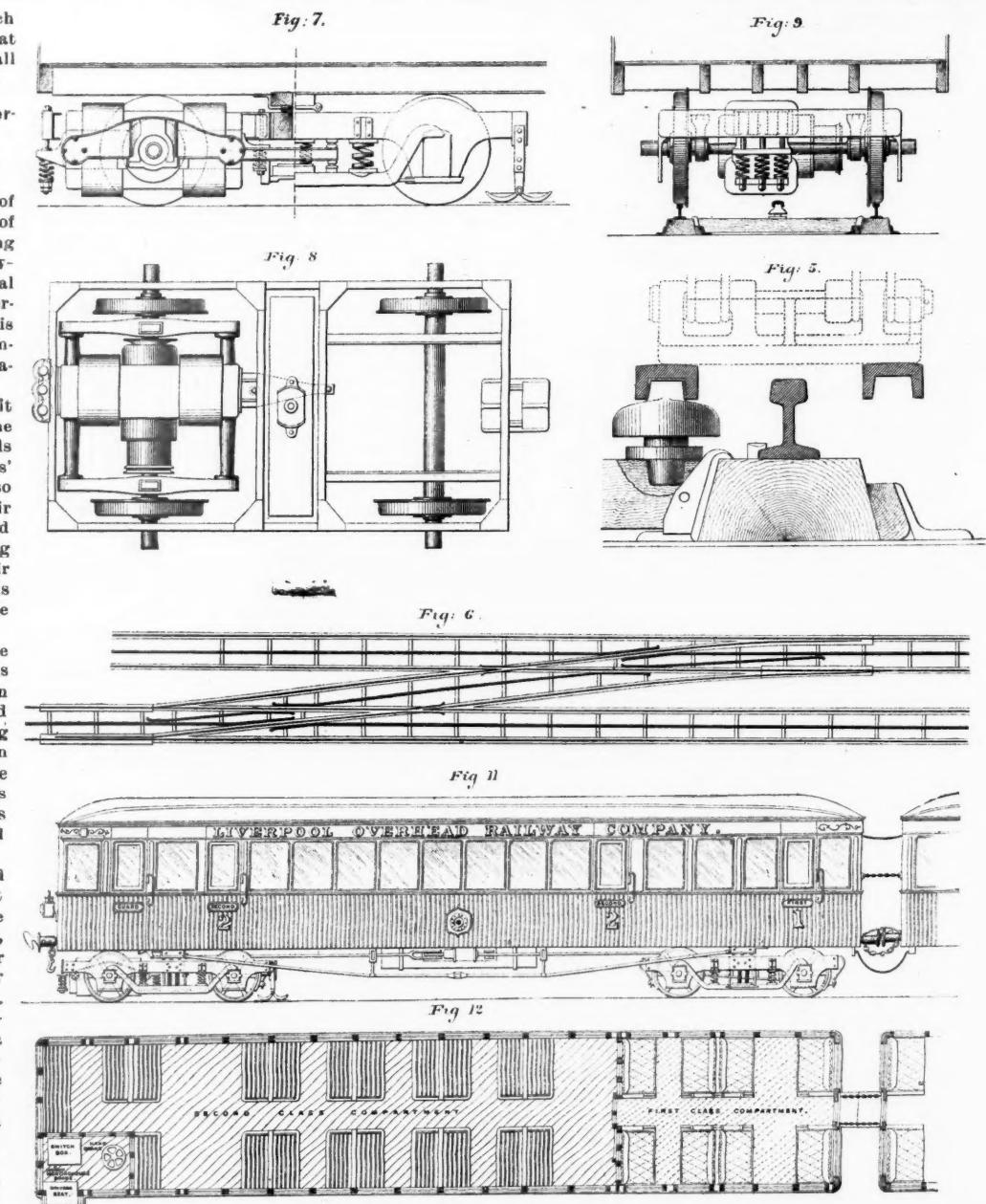
Transfers from foreign roads are handled readily, and promptly put out of the way of the regular trains. When a transfer informs the tower by annunciator where it wants to go, and gets the signal to start, it is sure to have its track ready for it, and complete for it to make its entire interchange. There is no being stopped by the whim of a flagman, or sent to some track where it may be pocketed an indefinite time.

Regarding the saving of time secured on account of interlocking, a comparison is made of delays occurring in April, 1893, when the crossing was protected by flagmen, and in the latter part of September and three days in October when protected by interlocking signals. This record was for twelve week days in each case and for eight hours per day. A record, taken in July, 1892, shows that 54% of all train movements over the crossing occur within the hours covered by the delay observation.

During the period of observations in April the roads were doing their regular average business, while in September and October they were crowded with World's Fair traffic. The Fort Wayne, during the latter period, besides taking care of all its own increased business, was also bringing all through trains of the Pan Handle Line for its Cincinnati and Louisville business over its tracks. In the Fort Wayne's passenger business over the crossing there was an increase of 109 per cent. between April and October. A decrease of 11 per cent. in their freight movements reduced the total increase on freight and passenger to 53 per cent.

For the 12 days record in April and October, the Fort Wayne had in April 41 delays, consuming 132 minutes;

* See *Railroad Gazette*, Jan. 29, 1892, for ground plan and description.



NOTE.—The Plate and Figure numbers of the original papers are retained.

In October 61 delays, consuming 84 minutes; a saving of 48 minutes, with an increase of 53 per cent. of train movements.

The Chicago & Alton had in April 9 delays, consuming 76 minutes, and in October 3 delays, consuming 6 minutes, a saving of 70 minutes, with an increase of 22 per cent. in train movements.

The Western Indiana road had in April 122 delays, consuming 5 hours and 59 minutes, and in October 83 delays, consuming 1 hour and 51 minutes, a saving of 4 hours and 8 minutes, with an increase of 20 per cent. in train movements.

The Santa Fe had in April 21 delays, consuming 1 hour and 26 minutes, and in October 14 delays consuming 39 minutes. There was a saving of 47 minutes in time lost, but on this road there was a reduction of 6 per cent. in train movements.

The Illinois Central had in April 17 delays, consuming 1 hour and 22 minutes, and in October 26 delays, consuming 37 minutes, a saving of 45 minutes in time with an increase of 32 per cent. in train movements.

For all the roads there were in April 210 delays, consuming 12 hours and 15 minutes, and in October 187 delays, consuming 4 hours and 37 minutes, a saving of 7 hours and 37 minutes in time, with an increase of 24 per cent. in train movements.

With flagmen on the ground handling this increased train movement, it is safe to assume that the delays would have been increased with at least equal ratio to the increase in train movements. If, therefore, to the delays in April, amounting to 12 hours and 15 minutes, there is added 24 per cent., amounting to 2 hours and 56 minutes, there would have been at least, for the twelve days in October, if the crossing had been protected by flagmen, delays amounting to 15 hours and 11 minutes. The actual delays with the use of the interlocking in the twelve October days were 4 hours and 38 minutes, or a saving of 10 hours and 33 minutes.

In comparing these delays by flagmen and under the interlocking signals, the amount of work done at the Indiana Elevator was not considered. In reality there was little work of this kind in April, while in September and October the elevator was busy. Between April and October there was an increase of 327% in the num-

ber of cars unloaded; all these cars being switched over the Fort Wayne track, and frequently over the Illinois Central and Santa Fe tracks.

The above will demonstrate to any doubter the practicability of handling a plant of this magnitude and complication with the Westinghouse pneumatic interlocking device, and that in so doing the saving, not only in expense, but in movement of trains is greatly increased; in fact, during the month of September the average daily train movements for 24 hours were 1,030, and during the busy hour between 9 and 10 in the morning 96, or a movement every $\frac{1}{4}$ of a minute, so that the truth of the remark of the one leverman employed in this tower, that he could double the number of train movements with perfect ease, is or should be apparent to any one.

G.

The Liverpool Overhead Railway.

At a meeting of the Institution of Civil Engineers (London) held Feb. 27, a paper by Mr. James Henry Greathead and Mr. Francis Fox, Members of the Institution, was read. The paper describes the construction, equipment and results of operation of that very interesting experiment in city railroads, the Liverpool Overhead. The paper was supplemented by one on the Electrical Equipment of the road, written by Mr. Thomas Parker, Member of the Institution. Messrs. Greathead and Fox were, as is probably well known, the consulting engineers of the railroad, and Mr. Parker is engineer for the Electrical Construction Corporation of Wolverhampton, the contractors for the equipment. Mr. S. B. Cottrell, Associate Member of the Institution of Civil Engineers, is the Engineer and Manager of the Railway Company.

We cannot reprint the paper in full, but reproduce those parts which bear especially upon the method of working and its cost. Probably the economy will surprise many of our readers. The first part of the paper describes the route and the structure. These have already been described at considerable length in the *Railroad Gazette*.* What follows is entirely in the language of the authors of the papers.

* See issues of Oct. 7, 1892, Feb. 17, 1893.

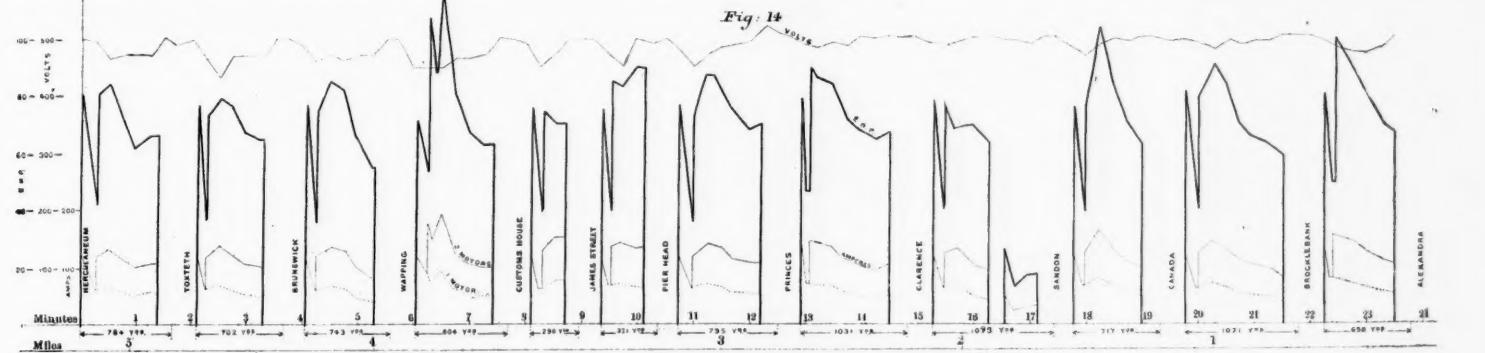
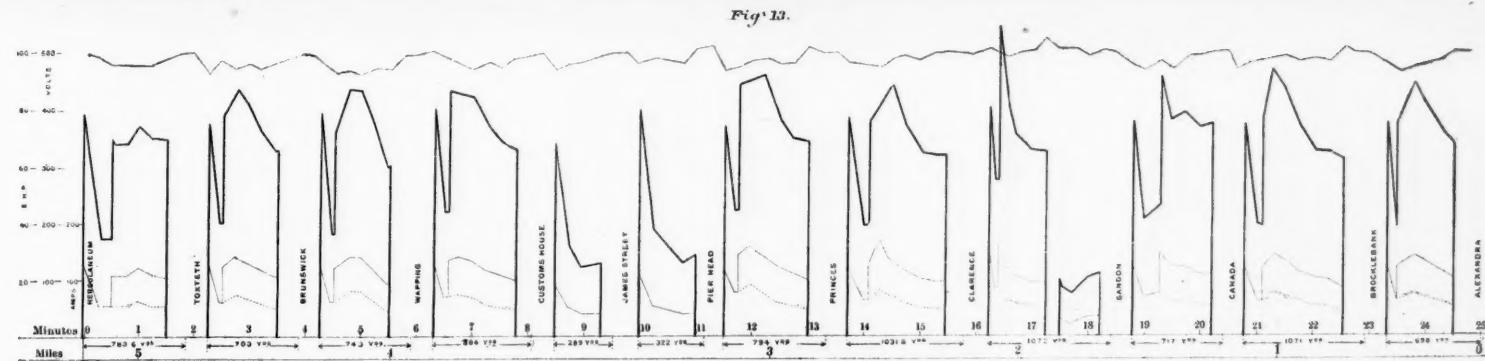


Fig. 17.



TRACTION DIAGRAMS, LIVERPOOL OVERHEAD RAILWAY—PLATE 2.

Motor Cars.—Where trains are heavy and long, and where the weight on the driving wheels is not a consideration, separate locomotives may be preferable, because it is undesirable to multiply machines, and it is an advantage to have all the machinery under the eye of the driver and readily accessible—in tunnel railways also there is more space for the motors in separate locomotives. In cases, however, where it is important to limit the weight on the driving-wheels, motor-cars afford an opportunity of running trains of any length without undue weight being thrown upon the structure. For instance, on the elevated railways of New York the structures will not admit of heavy locomotives; and though the engine is such as to tax the carrying capacity of the trains, run at the shortest possible intervals, to its utmost limit, and beyond considerations of convenience, larger trains cannot be introduced unless the structures can be strengthened or motor cars be adopted.

Lighter trains, resulting in better speed with a given expenditure of power, also follow from the use of motor cars. As an illustration of this derived from actual experience, the trains of the Overhead Railway may be compared with those of the City & South London Railway. In the former case the electrical equipment for motive power adds 6 tons 7 cwt. to the weight of carriages seating 114 passengers; while in the latter the corresponding weight (the locomotive) is 10 tons 7 cwt., 96 passengers being carried. The avoidance of shunting at the terminal stations is another important advantage attending motor cars. Every separate movement of even a light locomotive absorbs a comparatively large current, thus accentuating the irregularities of demand, already sufficiently variable, upon the generating engines and dynamos. Time is saved at the terminal stations and siding accommodation is reduced in length. Wear and tear of all kinds are reduced and the first cost of the trains is considerably less.

The design of the carriages, figs. 11 and 12, plate 3, received much consideration and the result is satisfactory both as regards weight and convenience. One train consists at present of two carriages, each 45 ft. long and 8 ft. 6 in. wide, on two bogies 32 ft. apart from center-pin to center-pin, with 2-ft. 9-in. wheels, 1-ft. wheel base and pressed steel frames. The carriages are all exactly alike and contain accommodation for 16 first-class and 41 second-class passengers in each carriage, with three side doors and a passage from end to end. The first class passengers are at one end of the carriage, and the driver's box, with switches, etc., is at the other. When the two carriages are coupled together to form a train, the driver's boxes are at the extreme ends and the two first-class compartments consequently together in the middle of the train. A small door through the contiguous ends of the carriages enables the guard or attendant to pass from end to end of the train.

The motors, one at each end of the train, are controlled from either end; the driver, of course, always traveling at the front end of the train and changing ends upon arrival at a terminus, carrying with him a key without which the motors cannot be operated. In a train thus arranged one driver and one conductor constitute the train staff, the guard as well as the driver having it in his power to cut off the current from the motors and to apply the brakes.

Brakes.—The trains are fitted with the Westinghouse automatic brake deriving its supply of compressed air from a reservoir on the train, the reservoir having a capacity sufficient for two complete journeys and being recharged each journey from a receiver placed at the terminus at the north end of the line. This system of working the brakes was previously applied by Mr.

Greathead and found to work well on the City & South London Railway, and has answered equally well here. The air-compressors are in this case worked by a small electric motor with a gas engine in reserve; and pending the completion of the northern extension, the compressed air is conveyed a distance of about $\frac{3}{4}$ mile through one of the gas tube rails of the parapet to the present northern terminus at Alexandra Dock station. A hand-brake is also provided at each end of the train. The carriages are lighted by 32 candle-power incandescent lamps connected with the working current, and the stations are lighted by similar lamps connected with a battery of accumulators placed under one of the platforms at each station. These batteries are in duplicate and are charged in series by the main generating dynamo.

Power Plant.—The coal is tipped direct from the railway trucks into large hoppers placed over the boilers, and is distributed by a conveyor to the shoots of the Vicars mechanical stokers with which the furnaces are fitted. There is thus no handling of the coal. Water from the adjacent dock is used for condensing, and the town water for the boilers. Mr. Thomas Parker, to whose skill is due the excellent design and construction of the electrical plant, supplements this paper with an account thereof, and it is therefore unnecessary to describe here the details of that work.

The boilers are of the double-flue Lancashire type, with cross tubes; they are of steel, six in number, each 8 ft. in diameter by 30 ft. long, with a working pressure of 120 lbs. per square inch, and Green economizers in duplicate are fixed in the main flues. The steam and feed-pipe ranges are also in duplicate. The engines are four in number, each consisting of a pair of horizontal compound condensing engines, built by Messrs. Musgrave & Co., of Bolton, who contracted with the Electric Construction Corporation to supply the engines and boilers complete, and with the company to erect the chimney shaft (165 ft. high), foundations of boilers, engines, etc. The high-pressure cylinders are $10\frac{1}{2}$ in. and the low-pressure 31 in. in diameter, with a stroke of 36 in., fitted with Corliss valves driven by Tripp gear, acted on directly by the governor. Each engine will develop 400 I. H. P. at 100 revolutions per minute, with 120 lbs. boiler pressure. All the engines exhaust to one condenser of the tubular surface type. The centrifugal circulating pump and air-pumps are driven by a Musgrave "No-dead center" vertical compound engine, and the condensing plant is in duplicate.

Each engine drives an Elwell-Parker dynamo, from which the current is conveyed north and south along each line of the railway by the steel conductor already described. Hinged collectors of cast iron, sliding upon this conductor, the top surface of which is about $\frac{1}{2}$ in. higher than rail level, allow the current when required to pass through the motors and to return by the wheels and the rails to the dynamos. At the crossings the conductor is bent to form wings parallel to the rail to be crossed, in the same way as is usually done at rail crossings.

Relative Economy, Steam and Electricity.—The question of the relative economy of the working of steam and electric locomotives is of great interest at the present time. The nearest approach to the Electric Overhead Railway at Liverpool seems to be the elevated railways in New York, worked by steam locomotives. In each case the trains are comparatively light, though the New York trains are heavier than those at present running on the Liverpool line, and in each case the stations are on an average about one-third of a mile apart. In 1889 an experiment was made upon one of the New York lines to determine the possibility and cost of working by electricity. The results of this experiment, with a continuous current system of elec-

tric traction, were used with considerable effect in the Parliamentary Committee Rooms on behalf of the Metropolitan Railway Company against the proposed Central London Railway in 1890; and a description of the experiments and the results and conclusions derived from them, with details of the cost of working the steam locomotives on the Manhattan Railway, was published in a paper by Mr. Lincoln Moss in October, 1890.* The main conclusion arrived at was that "the cost of direct electric propulsion would be four times that of steam locomotion" on the Ninth Avenue Rail-way.

It is not necessary now to describe in detail the arrangements and results of those experiments, but it may be interesting to mention that the New York experiments were made with a train of 53½ tons drawn by an electric locomotive of nine tons or more (the exact weight is not given) over a length of $1\frac{3}{4}$ miles of line, with four intermediate and two terminal stations, and having gradients of $\frac{1}{100}$, $\frac{1}{70}$ and $\frac{1}{54}$ against $\frac{1}{100}$ with the load. The average speed attained was 9.4 miles per hour, stopping at the four intermediate stations; the average power of the generating engine was 176.8 I. H. P. and the average power applied on the railway was only 26.7 effective H. P., giving thus an efficiency of 15 per cent, as regards the indicated and effective power. Estimates were made in detail of the cost of installing and working an electrical equipment capable of dealing with the traffic on the Ninth Avenue Railway, about five miles long. The total arrived at was £771,000, including 17 generating engines, each of 600 H. P., dynamos aggregating 11,000 r. p. m., and electric locomotives alone costing £126,000. The estimated working expenses for motive power, excluding interest on the first cost, came to £135,000 per annum, or to over 3s. per train-mile.

The actual cost of the whole electrical equipment of the Liverpool Overhead Railway, for six miles of line, has been little more than five per cent. of the above estimate for the Ninth Avenue line of five miles, and the working expenses for motive power are about 4d. per train-mile, the mileage being much below the capacity of the generating plant. With a train-mileage equal to that of the Ninth Avenue line the cost would not exceed 3d. per train-mile. The actual average consumption of coal on the Liverpool Overhead Railway is about 16 lbs. per train-mile for trains of about 38 tons weight with seating capacity for 114 passengers, running at an average speed, including stops at stations, of about 12 miles per hour; whereas the averages on the New York elevated railways are, as far as can be ascertained, 54 lbs. of coal per train-mile for trains of about 92 tons weight (including locomotives weighing 23 tons) running at an average speed, according to the official time-tables, of about 12 miles per hour, including stops at stations. On the Liverpool railway, during the last half year, over 95 per cent. of the trains were punctual to time. No returns are available as to the punctuality of the New York trains. The coal used at Liverpool is bituminous small coal (slack), while in New York it is anthracite of good quality. The New York fuel consumption includes the heating of the trains in cold weather, but on the other hand that of the Liverpool line includes the lighting of trains and stations and the working of the automatic signals. The working of the brakes is included in both cases.

It will thus be seen that, far from electric traction costing four times as much as steam-locomotive traction, it is actually less expensive after full allowance is made for the difference in the weights of trains and other circumstances, in the two cases considered; and

* Transactions of the American Society of Civil Engineers, vol. xxiii, and Railroad Gazette of July 11, 1890.

when the mileage of the electric line increases, the difference will be still more marked in its favor.
Ratios of Useful and Dead Loads.—The Liverpool empty train weighs 31 tons 2½ cwt., of which the electrical equipment for locomotion weighs 6 tons 7 cwt. With all seats occupied by passengers, the total weight is about 38 tons 6 cwt., but on occasions the standing-room in the train is also fully occupied, bringing the weight to perhaps 50 tons. The weight of locomotive equipment is thus about 125 lbs. per passenger, and about 20 per cent. of the total weight of the train with all seats occupied, each passenger being taken at 140 lbs. weight. A comparison of these figures with those of trains on other railways using electric and steam locomotives is given in Table A:

TABLE A.

	Electric motors.	Electric locomotives.	Steam Locomotives.
Liverpool Overhead Railway.	City and South London Railway.	Manhattan Railway, N. Y.	G. N' th'n Suburban Train.
Weight of motors or locomotive.....	T. C. Q.	T. C. Q.	T. C. Q.
Number of passenger seats in train.....	6 7 0	10 7 0	23 4 0
Weight of motors or locomotive per passenger, in lbs.....	114	96	240
Weight of full train (all seats occupied).....	T. C. Q.	T. C. Q.	T. C. Q.
Weight of motors or locomotive relatively to weight of full train, ex motors or locomotives, per cent.....	125	211	217
Average weight of empty carriages (ex motors) per passenger seat, in lbs.....	38 5 2	37 7 0	104 1 0
Weight of full train per passenger, in lbs.....	487	490	615
	752	871	972
			1,020

It need only be observed in reference to the above table that the comparison is very favorable, so far as weights are concerned, to the adoption of electric motor carriages where practicable and otherwise suitable.

Comparative Efficiency.—In other respects also, not indicated in the above table, the advantages of the Liverpool arrangement are considerable. The weight on the driving wheels of a full train is 13 tons 15 cwt., or about 36 per cent. of the whole weight of the train. Taking the minimum available adhesion at one-seventh of the weight on the driving wheels, this gives about 115 lbs. per ton of train, and the motors give an equal tractive force with a current of 133 amperes. The electric locomotives of the City & South London Railway, weighing 10 tons 7 cwt. each, give on the driving wheels 28 per cent. of the whole weight of the train similarly loaded, and an adhesion (at one-seventh of the weight) of 90 lbs. per ton, while the motors give a tractive force of 100 lbs. per ton with a current of 150 amperes. For comparison with steam locomotives, the District Railway trains may be taken. A train of 9 coaches, weighing empty 87 tons, and seating 400 passengers, is drawn by a locomotive of 40½ tons weight (of which 35 tons 13 cwt. is upon the driving wheels), having cylinders of 17 in. diameter and 24 in. stroke, and driving wheels, when new, of 5 ft. 0½ in. diameter. The weight on the driving-wheels is therefore 19 per cent. of the full weight of the train; and taking again one-seventh of this, the available adhesion is 61 lbs. per ton of train. With 120 lbs. mean effective pressure in the cylinders, the tractive force, allowing for the friction of the engine, would be about 70 lbs. per ton of train. It should be observed that the tractive force given above for the electric motors is available only so long as the stated currents pass through the motors, and that, as the speed increases, the current and, to a corresponding extent, the tractive force, are reduced.

These comparative figures are shown in the following table:

TABLE B.

	Liverpool Overhead Railway.	City and South London Railway.	District Railway.
Weight of train (all seats occupied).....	T. C. Q.	T. C. Q.	T. C. Q.
Weight on driving wheels,.....	38 5 2	37 7 0	0 157 10 0
Weight on driving wheels per cent. of train weight.....	13 15 0	10 7 0	35 13 0
Adhesion at one-seventh of weight on driving wheels, lbs. per ton of train.....	36	28	19
Traction force, lbs. per ton of train:.....	115	90	61
Motors with 133 amperes,.....	115	..	..
Motors with 150 amperes,.....	120	100	..
Locomotive with 12½ lbs. mean effective pressure in cylinders.....	..	..	71
Maximum tractive force per ton of motors or locomotive, lbs.....	730	367	231

The last line of Table B brings out a strong feature of the electric motor or locomotive, viz., that, weight for weight, it is much more powerful than the ordinary steam locomotive. The latter has not only to apply, but it has also to carry, the materials for and to generate the motive power. In a separate electric locomotive this advantage cannot be utilized to the same extent as is the case in the motor cars, but it is still considerable; because, in the one case, the whole of the weight of the locomotive is available for adhesion, and the motors can always be relied upon to exert a tractive effort exceeding the adhesion due to their own weight and that of the frame and wheels carrying them; while, on the other hand, even in the case of tank-engines, only about two-thirds of their weight is usually available for adhesion. Having regard to the large tractive force available, relatively to the weight of the train, on the Overhead Railway, as shown in the table, it is not surprising that the promptness with which the trains get up speed is frequently remarked upon by passengers.

THE ELECTRICAL EQUIPMENT—BY MR. THOMAS PARKER,
M. INST. C. E.

When the Overhead Railway Company in 1891 took

into consideration the employment of electric traction for their trains, the Electric Construction Corporation, of Wolverhampton, tendered for the equipment of the line, and secured an order for the complete installation, comprising boilers, engines, steam pipes, dynamos, rolling stock, station lighting and signals. The plant was required to run a three-minutes service on a double line six miles in length, and to accomplish this distance in 29 min., including stops of half a minute at each one of 13 stations. Each train was to consist of two cars, each car carrying 50 passengers, and being of an estimated weight of 12 tons 10 cwt. without motors.

To meet this service, 20 trains running at one time would be necessary, and in considering the power required at the dynamos, the subject was approached from its elementary basis. Curves were drawn to show the energy absorbed by one loaded train at every point in the whole length of the line, assuming various accelerations and intervals during which the brakes might be applied to bring the train to a standstill, the weight of a loaded train, with motors, being assumed to be 34 tons. These curves were modified and checked by the results of experience on ordinary railways, until results were obtained which would meet the service required. In most cases the stations were so near one another (in one instance under 300 yards, and in others 400 yards) that the brakes had to be applied long before the train could attain a uniform speed, the greater part of the energy supplied to the motors being expended in accelerating the motion of the train, which was required by the specification to attain a speed of 30 miles per hour, if necessary. From these curves it was an easy matter to calculate the power required for the whole service. This gave, allowing for the various electrical losses which were capable of being estimated, 1,200 to 1,400 amperes at 500 volts, which was the electrical pressure decided upon, or nearly 900 E. H. P. This was split into three units, and to allow for one spare, it was decided to use four dynamos for the generating plant, each having a normal output of 475 amperes at 500 volts, at 420 revolutions per minute, or say 1,200 E. H. P. in all.

Conductor.—The main conductor is of steel, 4 sq. in. in section (fig. 5, plate 3), rolled in lengths of 32 ft. 6 in., and weighs about 40 lbs. per linear yard. It is supported between the main rails on wooden cross-sleepers and rests on porcelain insulators. The insulators were designed for use with oil, but as the average leakage over the whole line is only 2 to 3 amperes, this has been thought to be an unnecessary refinement. The steel channel is not rigidly attached to the insulators in any way, and is supported by them at every 7 ft. 6 in., except where joints occur in the conductor, in which cases the insulators are 2 ft. 6 in. apart. The lengths of conductor are electrically connected by flexible copper straps. There are no feeders, and the return circuit is through the rails, which are united by wrought iron bonds riveted to the web and bridging across the fish-plates. All four rails are cross-bonded at the stations, but are insulated from the structure by longitudinal sleepers. They weigh 56 lbs. per linear yard. The return circuit has thus a sectional area of approximately 22 sq. in. At each station there is a cross-over road, and, in order to surmount the difficulty of carrying the charged conductor past the main rails at these points, it was broken, and each end was bent parallel to the main rail for some distance on each side of it (fig. 6, plate 3), being electrically connected under the rail, and fixed ¾ in. above it. The collectors on the cars were made wide enough to bridge across the gap thus formed, without breaking the circuit.

The tractive force of each motor at the rim of the wheels (2 ft. 9 in. in diameter), with 100 amperes exceeds 1,450 lbs. (about 87 lbs. per ton of train). The weight of each motor with its axle, but without the wheels, is 3 tons, and that of the motor truck complete is 5 tons 7 cwt.

That these motors will stand any stresses they are likely to be called upon to bear has been proved, and this fact has been found to be of great service in actual running; for, before the drivers were properly educated to their work, they frequently, on finding any difficulty with either motor on the train, such as brush-leads working loose, or brushes making bad contact, cut that motor out of circuit by means of a plug provided on the driving switch, and continued the traffic with one motor to the end of the line.

Power at Generating Station.—The efficiency of I. H. P. to E. H. P. on the line is very high, and results are given of special tests taken with carefully calibrated instruments. For this purpose No. 1 engine and dynamo were used. This engine had been running for some weeks, and was in thorough working order, the valves being carefully adjusted to give the best diagrams. The tests were taken after the engine had been running the traffic all day, when the load was transferred to a water-resistance tank. They lasted over three hours and a half, volts, amperes and speed being kept constant, and readings and diagrams taken every half hour.

The results of the tests are:

Diameter of high pressure cylinder, 15½ in.

Diameter of low pressure cylinder, 31 in.

Length of stroke, 36 in.

Mean efficiency (E. H. P. to I. H. P.), 88 per cent.

Coal consumed, 4,032 lbs.

Total E. H. P. hours, 1,195.

Coal per E. H. P. hour, 3.37 lbs.

Coal per I. H. P. hour (efficiency 88 per cent.), 2.96 lbs.

These results are eminently satisfactory, and are borne out by the low coal consumption in practice, of which mention will be made later.

Curves are given (figs. 13 and 14, plate 2), showing the power absorbed by a train during an experimental run covering the length of line at present open (5½ miles) in 24 min. and 57 sec., with intervals of 25 sec. stoppage at stations, or an average running speed of 15½ miles per hour. Also during one journey performed in 23 min. 47 sec., or at the rate of 16.1 miles per hour.

The particulars of these trials are:

MARCH 5, 1893. FIRST JOURNEY.

Herculaneum to Alexandra (return). One train on line.

Loaded with 8 tons iron weights.

Total time on journey, 24 min. 57 sec.

Total time current is on car, 17 min. 7 sec.

Total time train is standing, 4 min. 37 sec.

Total distance run, 9,030.4 yards = 5 miles 230 yards, say 5½ miles.

Average speed while running, 15 miles per hour.

Average speed, including stops, 12.3 miles per hour.

Average current per train while running, 82.7 amperes, including stop, 67.3 amperes.

Average electrical horse power per train while running, 54.4 H. P., including stop, 44.4 electrical H. P.

Average electromotive force, 485.2 volts on car.

MARCH 5, 1893. SECOND JOURNEY.

Herculaneum to Alexandra (return). One train on line.

Loaded with 8 tons iron weights.

Total time on journey, 23 min. 47 sec.

Total time current is on car, 15 min. 18 sec.

Total time train is standing, 4 min. 40 sec.

Total distance run, 9,030.4 yards: say 5½ miles.

Average speed while running, 16.1 miles per hour.

Average speed, including stops, 13 miles per hour.

Average current per train while running, 90.8 amperes, including stop, 73 amperes.

Average electrical horse power per train while running, 57.1 electrical H. P.; including stop, 46 electrical H. P.

Average electromotive force on car, 484 volts.

The weight of the car complete without passengers is 15½ tons. For the test each car was loaded with 4 tons, making the total weight of the train 39 tons. The average power absorbed was 44.4 E. H. P. at 15.1 miles per hour, and 46 E. H. P. at 16.1 miles per hour.

A comparison of the consumption of coal when the number of trains is varied is interesting. During the month of April and part of May there were seven trains on the line, giving a 10-minutes service from 5:10 a. m. to 6:40 p. m. During this period the coal burned was 22.55 lbs. per train-mile. This includes coal for all purposes, no deductions being made for charging the station batteries, etc.

From June to the beginning of October the train-service has been as follows:

5:00 a. m. to 9:00 a. m., 8 trains in service.

9:00 a. m. to 5:30 p. m., 12 " " "

5:30 p. m. to 7:00 p. m., 6 " " "

7:00 p. m. to 8:30 p. m., 4 " " "

giving a five-minutes' service from 9:00 a. m. to 5:30 p. m.

The coal used for all purposes per train-mile has been—

	Lbs.
April.....	25.16
May.....	20.63
June.....	18.97
July.....	18.27
August.....	16.95
September.....	17.20

The figures show a continual steady decrease in fuel consumption. That for August is abnormally low, due to extra traffic during the holiday week, the car-mileage on the 7th of that month being 21 per cent. greater than usual. On that day the trains carried 48,000 passengers, each train during the middle part of the day being loaded with over three hundred people. The average weight of slack burned during the four months of June, July, August and September, inclusive of all battery charging and power at the central station and carshed, was slightly less than 17.8 lbs. or, allowing for energy expended otherwise than on the trains, it may be taken at 17 lbs. per train-mile.

TABLE SHOWING COAL CONSUMED PER KILOWATT-HOUR, ETC.

	Kilowatts generated.	Pounds per kilowatt-hour.	Pounds per E. H. P.-hour.
April.....	69.954	8.40	6.32
May.....	86.627	6.99	5.17
June.....	97.789	7.10	5.30
July.....	109.909	6.70	5.00
August.....	117.843	5.95	4.44
September.....	119.328	5.81	4.31

During four days in June, owing to the dock from which condensing-water is drawn being emptied, the engines ran non-condensing, and an additional boiler was required.

The coal used is small Lancashire slack, having the following composition:

	Per cent.
Fixed carbon.....	70.68
Volatile hydrocarbon.....	16.47
Sulphur.....	1.92
Moisture.....	3.01
Ash.....	8.51

Its calorific value is approximately 75 per cent. of that of best Welsh coal. The price of the slack which was used until the latter part of August was 5s. 1d. per ton, but since that date, owing to the strike in the coal trade, coal has been procured from various sources at price ranging up to 17s. 6d. per ton.

Cost of Working.—Under their agreement, the contractors engaged to run the service of trains for the Liverpool Overhead Railway Company, and to supply all power, maintenance, drivers, superintendence, etc., if required, for a period of two years, for the sum of 3½ d. per train-mile, which was estimated upon an average daily running of 2,400 miles. At the present time only 5½ miles of line have been opened for traffic, and the contractors have received 4d. per train-mile, as, with a five-minutes' service the total train-mileage is necessarily decreased on the shorter line. For current to charge the station batteries 7d. per unit is received, which includes the maintenance of lighting and signal plant. In the table are given figures analyzed from the actual working costs during the months of July, August and September.

The increased cost of running during August and September is fully accounted for by the item of coal; and, taking into consideration the fact that the Overhead Railway Company has not employed so rapid a service as was at first anticipated, the average running per day being only about 1,350 train-miles, the figures indicate most favorable results; as, even with this mileage, the trains were run at a fair profit for July and August, and it is evident that with coal at a normal value, the line can be run at a cost within that guaranteed by the contractors.

COST OF WORKING, INCLUDING THE LIGHTING OF STATIONS AND THE SIGNALS.

	Pence per train-mile.		
	July.	August.	September.
Supervision.....	0.416	0.416	0.416
Generating station, wages.....	0.618	0.590	0.628
Drivers' wages.....	1.076	1.013	1.058
Coal.....	0.589	0.718	1.230

The "Hillside" Loops of the North Hudson County Railway.

The primary object of this article is to describe a very interesting piece of construction work recently completed by the North Hudson County Railway in Hoboken, N. J. The problem was to overcome a vertical ascent of 160 ft. in about 700 ft. of horizontal distance; that is, to carry an electric railroad from the corner of Madison avenue and Fifteenth street, as shown on the plan herewith, to the plateau at the summit of the steep hill back of the flat on which the main part of the city of Hoboken stands. This was done by developing a line of 3,688 ft. in going the horizontal distance of 700 ft. The alignment of this work is shown on the plan herewith.

Beginning at Fifteenth street and Madison avenue there is a curve of 75 ft. radius, including about 90 deg.; then there is a pile trestle followed by a framed trestle on piles, a second curve of 75 ft. radius, a plate girder viaduct over the Erie tracks, another curve of about 75 ft. radius, including 94 deg. of curvature, and then comes the heavy side-hill work. The contour lines on the plan show the slope of the hill, which is of trap rock. The slopes formed by wasting from the side hill cut are indicated by hatching and the retaining walls by stippled work. The location was made somewhat more difficult by the necessity of avoiding the Hillside wagon road, which is

these two elevated steep-grade lines, the company operates about 13 miles of trolley road on the surface, interchanging at various points with the horse car lines. The company, by means of the lines which it owns, or those which it controls, operates lines as far south as the Pennsylvania ferry in Jersey City, touching the Pavonia Ferry of the Erie also, and as far north as the North Hudson Driving Park track. It carries about 17,500,000 passengers a year.

The electric power equipment for the Hillside line consists of a 1,400-H. P. Corliss cross-compound engine in the power station of the Hudson Electric Co. at Fifteenth street, with the necessary generators. At Palisade avenue and Ferry street, about a mile further south, the company has its own power station, where there are two Watts-Campbell Corliss engines of 500 H. P. each and three Ball, single expansion engines of 250 H. P. each, driving the necessary Thomson-Houston generators. The Corliss engines at this station were designed to operate the cable plant.

Air Brakes and Their Maintenance.

In the *Railroad Gazette* of Feb. 9, page 100, appeared an abstract of the paper by Mr. G. W. Rhodes, under the above title, read at the January meeting of the Western Railway Club. The discussion of that paper had at the February meeting is given in abstract below.

Mr. BARNS: If any question is important to railroads

On a great many cars the coupling does not come anywhere near the ties; there are no cars in our service, or coming to us from connecting lines, where hose cannot be raised from 3 to 6 in., sufficient to get the coupling entirely out of the dirt or out of the reach of crossings and frogs. By straightening out the valve to which the hose is attached and changing the angle slightly, the coupling on the end of the hose will not hang down as much as it does now; it will be more difficult to reach from one car to another.

Mr. QUEREAU: If with the shorter lengths the hose is always to be hung up, it will break near the pipe connection.

President FORSYTH: It is the object of one of the Master Car Builders' late standards to avoid such breakages; is this object attained?

Secretary STREET: Mr. Waitt, of the lake Shore road, claims that they have no broken hose where the coupling is used.

Mr. TOWNSEND: We get our hose short enough so that they do not drag on the ground. They are about four inches above the rail; where we hang them on the dummy coupling, it kinks the hose and finally breaks it; until we can get some better appliance for coupling-up, the hose had better hang down.

Mr. GIBBS: If we could hang our hose as they do abroad, above the level of the end sills, the trouble from dirt might be obviated; hanging up the hose produces a kink which quickly destroys the hose.

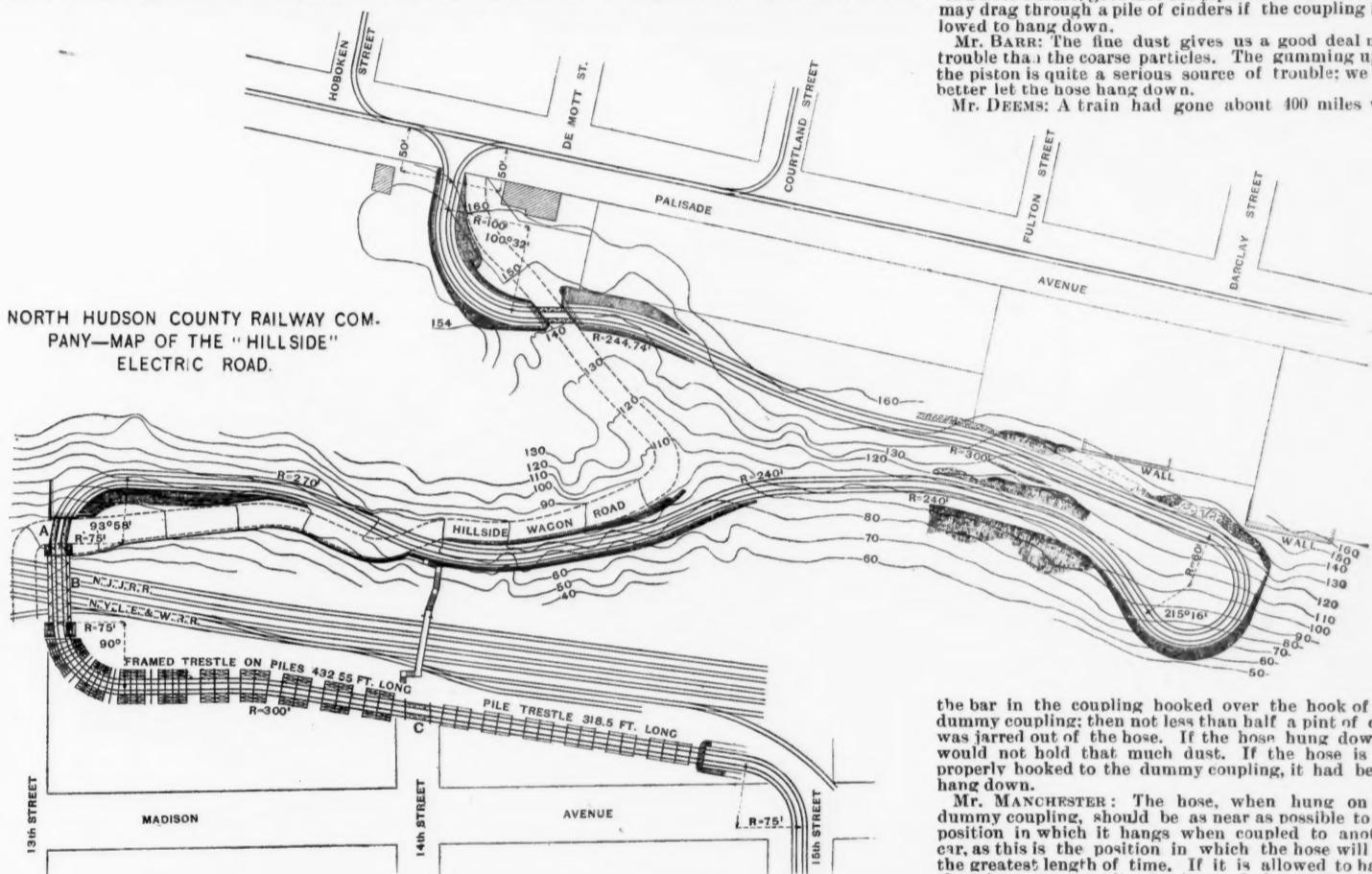
Mr. FILDES: We do not find that trouble with the use of the latest M. C. B. standard at all; the hose when hung up forms a curve without any kink. It is not inconvenient because both can be handled from one side of the car.

Mr. MARSHALL: It is shown in Mr. Rhodes' paper that, in hanging the hose up, more or less dust, though of a finer nature, goes into the pipe. Even a short hose may drag through a pile of cinders if the coupling is allowed to hang down.

Mr. BARR: The fine dust gives us a good deal more trouble than the coarse particles. The gumming up of the piston is quite a serious source of trouble; we had better let the hose hang down.

Mr. DEEMS: A train had gone about 400 miles with

NORTH HUDSON COUNTY RAILWAY COMPANY—MAP OF THE "HILLSIDE" ELECTRIC ROAD.



also shown on the plan. At the extreme right it will be seen is a curve of 60 ft. radius and over 215 deg. of curvature. The maximum grade is $5\frac{1}{2}$ per cent. The railroad is double track, as shown on the plan, and the whole construction is very substantial. The retaining wall at the extreme right is 70 ft. high.

The structures other than the trestles mentioned are a 40 ft. plate-girder, double-track bridge at A, a 92-ft. lattice girder at B, and a 30-ft. plate girder at C, and the bridge at the crossing of the Hillside wagon road. The track is laid with 56-lb. rails from the Pennsylvania Steel Company, and guard rails of 32-lb. section are laid inside for the whole length of the road on the heavy grade. The track is ballasted with stone. Great care has been taken to secure perfect drainage, there being two 24-in. cast-iron pipes the entire length of the road. The cost of this piece of work from Madison avenue to Palisade avenue was \$120,000, exclusive of the right of way. It was executed under Mr. Myles Tierney, Contractor, now President of the N. H. Co. Ry. Co., and Mr. C. B. Brush, Chief Engineer.

The North Hudson County Railway consists of 50 miles of track, of which about 24 miles is operated by horses, 16 is trolley road, and 7 miles is operated by steam. The Hillside section which we have just described is a trolley road. The nearest ferry to this portion of the road is from West Fourteenth street in New York to Fourteenth street in Hoboken. The system also reaches the ferry from Barclay and Christopher streets, New York City, to the D., L. & W. station in Hoboken. From this ferry it has an elevated line going straight up to the plateau on the top of the hill, which was built some years ago to be operated by cable, but within 12 months the cable machinery was replaced by electrical machinery, and this is now a trolley line. Aside from

it is that of brakes in interchange. It will soon be the case that if the triple be found in bad order at interchange points, it will either have to be taken off and cleaned or a new triple put on; it will probably be an exchange of triples. Triples do not wear much; therefore the exchange of a new triple for an old one would not make much difference and this would be quicker. It is shown that brakes work well under very bad circumstances, and, further, that they can be cleaned at a nominal expense, but they must be watched carefully. The quick action feature of the air brakes will always work when the strainers are clean with maximum efficiency, if this feature acts at all. This is not true of the service feature. The quick action of an old brake will go on just as quick as on a new brake; but the strainer must be kept clean.

Mr. PECK: We frequently find air brakes cut out, return them cut out and deliver them cut out. One great trouble with air brakes is that too many cars are run with the hose dragging and getting filled up with dirt and cinders, and when they are coupled up the dirt will naturally fill the strainers.

Mr. BARR: We must increase our expenses in order to take proper care of the air brake equipment.

Mr. DEEMS: By allowing the triples to get dirty the brakes not only cease to be a factor of safety, but become expensive in sliding wheels. In a train of cars some of the triples are clean and the emergency feature will act in them and not in others. Under such conditions it is utterly impossible for an engineer to properly control his train. There are a great many bills paid for damage that comes about in that way.

Mr. GIBBS: The number of brakes found inoperative on one division of the C. B. & Q. road in nearly every train there were from four to eight brakes out of order; if these be on successive cars of the train it would be impossible to obtain an emergency application. If the hose is allowed to hang down, dirt lodges in the coupling; this dirt is blown through the pipes with the first application of air. If the hose is kept hung up fine dirt sifts in and falls immediately into the hose pocket, and the same difficulty results. It is desirable to do away with the pocket in the coupling where dirt lodges.

Mr. DELANO: The best way of taking care of hose is not to hang it up. The standard length of hose is 22 in.

the bar in the coupling hooked over the hook of the dummy coupling; then not less than half a pint of dust was jarred out of the hose. If the hose hung down it would not hold that much dust. If the hose is not properly hooked to the dummy coupling, it had better hang down.

Mr. MANCHESTER: The hose, when hung on the dummy coupling, should be as near as possible to the position in which it hangs when coupled to another car, as this is the position in which the hose will last the greatest length of time. If it is allowed to hang, there is an opportunity for it to chafe on the brake beams, and it would not be long before there would be a weak point.

One of our workmen made an air-screen or strainer. An air-screen passed across part of the chamber; the other portion of the chamber was packed with sponge, and the air had to pass through it, which took out the dust, the screen holding the coarse particles. After 14 months' service it showed a circle about $1\frac{1}{2}$ in. in the center all clogged up. The outer edge was still open and would have done duty much longer. The sponge would still have strained out dust for a much longer time. The report of the triple that was protected by this screen was that it was in very clean condition. A sponge or other fiber is good if an area sufficiently large is obtained.

Mr. SQUIRE: If the screen were packed as suggested by Mr. Manchester there would still be sufficient air passage to obtain the emergency feature of the triple. A filter of sponge, felt or curly hair having an area about six square inches, placed back of a screen, would after two or three years' service pass enough air to operate the emergency feature of a triple valve.

Mr. BARNES: It is important to have the strainers, not only in the triple, but also in the train pipe accessible so they can be easily removed and cleaned.

Mr. PECK: The amount of stuff shown as coming out of a new pipe would almost ruin any triple valve. The pipes should be cleaned before they are put in, as this scale is more harmful to a triple valve than any dust.

Mr. RHODES: I have a sketch which shows the idea of a spoon-shaped coupling suggested by Mr. Gibbs. If any dirt gets in this it will drop out.

The next important consideration, if the hose is to be hung up, is the location of the dummy coupling. The Westinghouse company did not really indorse the method of hanging the hose adopted by the M. C. B. Association. If the hanging up of the hose is going to be obligatory it should be hung up on the other side of the drawbar. If you require trainmen to get underneath to hang up hose, you will be criticised; the action of the Master Car Builders' Association is one which in a short time they will take back.

The matter of having pockets for dirt so as to keep it out of the passage from the train pipe is receiving attention from the manufacturers.

I would move that a committee be appointed from

this club to submit a blank for conductor's report of brakes in bad order. Already several lines are looking after the question of brakes and are working independently, and I have here a sample of defective air-brake cards used on the L. S. & M. S. Ry. Lines like the Union Pacific, Atchison, Topeka & Santa Fe, Southern Pacific and others who have their methods of maintaining brakes in pretty good shape, a card of this kind would not be useful. This committee might consider two things: First, a form of report which the conductors shall use in case they have air-brakes in bad order on their trains; and second, the advisability of putting some card on the car stating what is defective in the brakes on that particular car. I would move that such a committee be appointed. The committee is: Messrs. Delano, Manchester and Townsend.

Mr. TOWNSEND: We have our car repairers' report at Kansas City, Slater, Roohouse and Chicago that cars are in good working order; if they are not they are so reported, and when they get to Bloomington are always shifted out of the train if not loaded, and fixed. We also have a road card that the conductor puts on if he finds a car upon which the air-brake is not in good order. He tucks the card on the car and it goes to Bloomington and is fixed.

Mr. CLOUD: I am greatly surprised to hear members on this floor question the desirability of hanging up hose. I know of no facts which can properly be used to support that view that hose be allowed to hang down. The hose ought to be hung so that it will not kink. If the hose is hung up as it should be hung, it will keep out a great deal of dirt and especially dirt which is scooped in by running through cinder piles, etc. Formerly we used sponge in the drain cups; the construction of the drain cup is such that it is an open train pipe and the air passes through the open cylindrical screen. The air which goes to the triple valve and brake on one car passed through the sponge which surrounded the perforated cylindrical screen. The sponge was removed because it was apt to absorb water and freeze in cold weather.

The screen should be a cylindrical screen with wide open train pipe and small openings for the air to pass through laterally to the brake on the car. The dirt then will be blown through largely, and if you open the cock on the rear end of the train and allow it to blow through occasionally, the largest part will be blown out. Not only one-half but nine-tenths of the trouble with dirt in air-brakes results from the failure to properly hang up the hose. The small amount of fine dirt that will come in with the air through the pump, if the hose is properly hung up, if it passes the train-pipe screen and the triple valve screen, will be fine enough to go clear out to the atmosphere again. What stops in the triple valve is not enough to harm the action of the triple valve unless there is too much oil in it or it is inactive for long time; in the latter case it is likely to become gummed up, with or without dirt, so that it needs cleaning before it will properly operate.

Switching Locomotive for the Brooklyn Bridge Terminals.

The trustees of the New York & Brooklyn Bridge have recently introduced a locomotive for bridge service of new design, built by the Baldwin Locomotive Works. The engine differs from the old type in being heavier, more powerful, of shorter wheel base and in having pony trucks. The locomotives heretofore used on the bridge had 33-in. driving wheels and a 6-ft. wheel base; this one has 40-in. wheels and 5-ft. 8-in. wheel base. The bridge locomotives are required to run upon reverse curves, some of which are 100-ft. radius, and the old ones were very destructive to the track and flanges of the drivers. The life of a rail in these places was about six weeks. They have, therefore, adopted a shorter wheel base and a larger driving wheel, and to prevent the tilting of the engine from its being top heavy, two pony trucks have been introduced, one at each end of the locomotive. The larger wheels and smaller wheel base narrow the space for the brake rigging, but it has been successfully put in.

The pony trucks fore and aft have 27½-in. wheels, carrying a frame hung from elliptical springs resting on the oil box. This frame carries four suspension links, which support the center plate. The king bolt is 4 in. in diameter, enlarged to form a bearing surface and resting upon this center plate. An equalizing lever connects the pony truck and the locomotive frame, which can be so adjusted as to relieve or increase the weight on the drivers. The pony truck frame is independent of the engines except at the point of suspension where the king bolt bears upon the center plates. The links give the necessary lateral motion.

The boiler is 50 in. in diameter, while the old one was but 36 in. Eight hundred gallons of water and one ton of coal are carried. The total weight of the old engines was 23 tons, while the light weight of the new is 32½ tons.

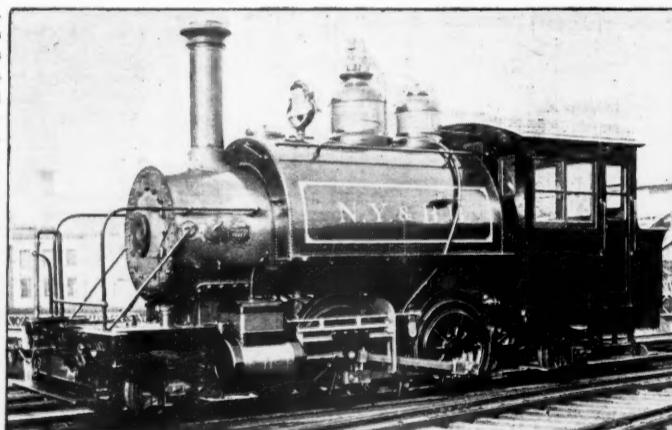
The engine is provided with a balance valve, while the old ones had the old-fashioned D valve. Its balancing is accomplished by making recesses in the back of the valve and near the edges. Into these recesses are fitted metallic strips, which compress small springs inserted in sockets under them. When the valve is fitted in place these springs force the strips up against the top of the steam chest, and thus prevent access of the steam to the top of the valve, and thus relieve the pressure upon it.

Some tests with these engines have been made, which show them much more powerful than the old ones.

This engine has hauled six unloaded cars, weighing 102 tons, across the bridge, which has grades as steep as 175 ft. to the mile. At another time four standard cars with 160 passengers, weighing 86 tons, were hauled across the bridge at cable speed, and later the engine took three cars, making a load of 68 tons all told, across the bridge, making a stop on the steep grade and starting again.

The engine was guaranteed to accomplish one-half more than the old locomotives which will draw about two cars, and as above noted, will so do. The locomotive is of a special type and built after designs and specifications prepared by Mr. John H. Converse, of the firm of Burnham, Williams & Co. The following table of dimensions gives data of the essential parts:

GENERAL DIMENSIONS.	
Type.....	Switching, for Brooklyn Bridge Terminals
Name or number.....	Spec. No. 7,211
Name of builder.....	Baldwin Locomotive Works
Gage.....	4 ft. 8½ in.
Simple or compound.....	Simple
Kind of fuel to be used.....	Anthracite
Weight on drivers.....	Tank full, 33,000 lbs.
" " truck wheels.....	Variable
" " total.....	68,000 lbs.
Wheel base, total, of engine.....	17 ft. 7 in.
" " driving.....	5 ft. 9 in.
" " total (engine and trucks, wheel base).....	17 ft. 7 in.
Length over all, engine.....	24 ft.
" " total, between drawheads.....	18 ft.
Height, center of boiler above rails.....	13 ft.
Heating surface, firebox.....	50 sq. ft.
" " tubes.....	410
" " total.....	490 "
Grate area.....	14½ "
Wheels and Journals.	
Drivers, number.....	4
" diameter.....	42 in.
" material of centers.....	Cast iron
Truck wheels, diameter.....	Tread, 27½ in.
Journals, driving axle, size.....	6½ × 8 in.
" truck.....	3½ × 6 in.
Main crank pin, size.....	Journal, 3½ × 3½ "
Cylinders.	
Cylinders, diameter.....	14 in.
Piston, stroke.....	18 in.
" rod, diameter.....	2½ in.
Kind of piston rod packing.....	Flexible packing (fibrous)
" air rod, length center to center.....	5 ft. 5¾ in.
Steam ports, length.....	12 in.
" width.....	1 in.
Exhaust ports, length.....	12 in.
" width.....	2 in.
Bridge, width.....	7½ in.
Valves.	
Valves, kind of.....	Balanced, with vacuum valves
" greatest travel.....	3¾ in.
" outside lap.....	1 in.
" inside lap or clearance.....	1 in.
" lead in full gear.....	1 in.
" constant or variable.....	Variable
Boiler.	
Boiler, type of.....	Straight barrel, regular locomotive
" working steam pressure.....	160 lbs.
" material in barrel.....	Ham, cast steel
" thickness of material in barrel.....	7 in.
" diameter of barrel.....	at smokebox end 50 in.,



Switching Locomotive for the New York & Brooklyn Bridge.

Seams, kind of horizontal.....	double riveted.
" " circumferential.....	single
Thickness of tube sheets.....	½ in.
" crown sheet.....	¾ in.
Crown sheet stayed with....	1 in. radial staybolts screwed and riveted
Dome, diameter.....	2 ft. diam. 2 ft. high
Tubes.	
Tubes, number.....	162
" material.....	Iron
" outside diameter.....	1½ in.
" length over sheets.....	6 ft. 10¾ "
Firebox.	
Firebox, length.....	54½ in.
" width.....	38 in.
" depth front.....	10 "
" " back.....	37 "
" material.....	Ham, cast steel
" thickness of sheets.....	½ in.
" brick arch? No.....	½ in.
" water space, width: front, 3½ in.; sides, 2½ in.;	
Grate, kind of.....	Water tube and wrought iron bars
Smokebox.	
Smokebox, diameter.....	50 in.
" length.....	44½ "
Other Parts.	
Exhaust nozzle, single or double.....	Double
" " variable or permanent.....	Permanent
" " diameter.....	2½ in.
" distance of tip above or below center of	
boiler.....	
Netting, wire or plate.	
Center	Steel plate
" size of mesh or perforation.....	
Stack, straight or taper.....	Straight
" least diameter.....	13½ in.
" greatest diameter.....	13½ in.
" height above smokebox.....	5 ft. 2½ "
Track curves of 100 ft. radius, maximum grades.....	3.77 per cent.

Steel Rail Specifications.

We have received from the Pittsburgh Testing Laboratory the following specifications for steel rails, which have just been printed. They are considered "about as complete and concise as it was possible to make them, and up to date." It will be observed that they are so worded that each copy will serve to govern the manufacture of a particular lot of rails, at a specified mill, for a certain railroad, the spaces in the different clauses to be filled in by the purchaser or by the testing company. It will be seen also that provision is made in Clause 14 for the stamp of the inspecting company, which is put on all rails accepted by that company. The specifications as they follow are essentially as issued by the testing company.

Specifications to govern the manufacture of tons of lb. steel rails, section, to be made by at works, for Time and amount of deliveries.

1. The steel for rails must be made by the Bessemer process and conform to the following standard. [Chemical analysis follows.]

2. A report of the carbon analysis of each blow must be furnished the Inspector by the manufacturer; also reports of all complete analyses as often as made. The Inspector shall have a right to ask for a complete analysis of any blow as to the quality of which he is in doubt.

3. At the discretion of the inspector, physical tests of any or all blows shall be made as follows: While steel is being poured from ladle into ingot molds a small ingot shall be taken from the middle of pour, such ingot to be large enough to allow not less than three clean bars ¾ in. square by 10 in. long to be forged therefrom at one heat. Two such bars when cold must bend to a right angle by sledging without breaking or showing signs of fracture. If two bars stand the test, the steel from that blow is to be accepted, provided the chemical analysis is satisfactory. If two bars fail, the steel, after being rolled into rails, to be subjected to the drop test as follows: A piece of rail, from the blow in question, not less than ft. long resting on solid iron or steel supports placed ft. apart to stand a weight of 2,000 lbs. falling ft. If the piece of rail breaks under this test, shows signs of fracture or bends to such a degree as to indicate soft steel, the Inspector shall reject all the rails from that blow, or make another drop test from same and accept or reject the rails according to the outcome of latter test and the chemical analysis of the steel.

4. The Inspector shall have the right to reject any cast of steel; in the ladle in which if "ferro" is used the latter is not properly mixed with the metal (either insufficiently heated or in large lumps); any bled or badly teemed ingots; any overheated ingots or blooms; any bloom insufficiently cropped; or any steel which before, during or after heating or rolling shows bad flaws of any kind.

5. The section of the rail must conform accurately to the template which must be made according to the dimensions given in drawing or print furnished by purchaser. The fit of the male or female template must be perfect. The finishing pass must be changed as soon as the section of the rail fails to conform to template. A piece of the rail from first accepted rolling shall be furnished the Inspector by the manufacturer and, if Inspector so desires, as often afterwards as finishing pass is changed. Such piece to be not less than 3 in. long and smoothly planed and filed on at least one end.

6. The rails must weigh as near to pounds per yard as is practicable after section has conformed to templates. Facilities for weighing single rails must be provided by the manufacturer. A variation of one per cent. on single rails and one half of one per cent. on every tons rolled will be allowed. Rails will be accepted and paid for according to weights.

7. The name of maker and place and date of manufacture must be rolled in plain characters on side of web of each rail. The number of the blow must be marked in plain figures on the side of web of each rail far enough back from end of rail as not to be covered by angle bar. If the purchaser so orders, the number of blow is to be stamped on end of each rail.

8. The hot saws must be so sharpened and adjusted as to cut the rails smooth and square, and reduce the burrs left on ends of rails to a minimum. This same rule applies to cold sawing.

9. The standard length of the rails at 60 deg. Fahrenheit shall be 30 ft. Shorter lengths of ft. will be accepted to an amount not exceeding ten per cent. (10%) of order. A variation in length of ¼ in. longer or shorter than above lengths will be accepted.

10. The rails must be straight in all directions, free from twists, kinks and sag marks and so cambered and treated on hot beds that the amount of work under straightening presses is reduced to the lowest possible point. Rails must not be straightened until they are cold enough to handle with bare hands.

11. Circular holes must be drilled with a twist drill through the webs of the rails as follows: Diameter of holes,; distance from end of rail to center of first hole,; from center of first hole to center of second,; from center of second to center of third,; from bottom of flange to centers of holes, All holes must be drilled clean, full to size and leaving no burrs.

12. All burrs on rails must be well chipped and filed off, especially on those parts of rails where angle bars have a bearing.

13. The rails must be rolled smooth and be free from flaws, honeycombs and blisters.

14. The Inspector shall have free entry to the works where these rails are being made at any time while this contract is being filled. He shall have the right to reject any steel, in the form of ingots, blooms or rails, which he considers unfit for service. All rails accepted by the Inspector must bear the P stamp, either on the end or side of web of rail; in the latter case the stamp must be put far enough back from the end of rail as not to be covered by angle bar.

15. Rails must be carefully skidded into cars. In no case must cars be used so short in length as to allow the end of rails on one car to come in contact with those on another car in transit. When rails are loaded on stocks or gondolas and ends of rails rest on end doors of cars, the rails must be supported as to bring their centers on a level with their ends.

CAUSES FOR TEMPORARY REJECTION OF STEEL OR RAILS.

1. Missing reports of chemical analyses or delay in making physical tests.

2. Imperfect ends (either with flaws, bad drilling, or so badly crooked as to make it impossible to straighten without injuring steel), which when cut off on cold saw would give a short rail of standard length.

3. A variation of more than ¼ in. from standard lengths. In this case the end of rail can be cut off, making a rail of shorter standard length.

4. Crooked rails, unless they be so very crooked as to necessitate too much work under presses in order to re-straighten them.

5. Such flaws as cause the rails second instead of first quality.

CAUSES FOR PERMANENT REJECTION OF STEEL OR RAILS.

1. Unsatisfactory chemical analysis or physical tests.

2. The presence of such flaws in ingots, blooms or rails as in the judgment of the Inspector renders the steel unfit for service.

3. An imperfect rail section.

N. B.—In all cases where the word Inspector is used in these specifications it means the Inspector of the Pittsburgh Testing Laboratory, Limited, acting for the purchaser. The amount of carbon, manganese, phosphorus, sulphur and silicon in the steel shall be specified by the purchaser or by the Pittsburgh Testing Laboratory, Limited. In the latter case specifications for such elements will depend on the section of rail, nature of

roadbed and climatic conditions. The measurements for drop test shall depend on weight of rail per yard.

Second quality rails to the extent of per cent. ("of," or "in addition to") this order will be accepted according to these specifications and the judgment of Inspector.

Current Practice in Plate Girders.

At the meeting of the Engineers' Club of Philadelphia on March 3 Prof. Edgar Marburg read a paper with the above title, and called attention to the fact that great diversity of opinion exists among engineers regarding proper methods of proportioning plate girders, the reason being that while theoretical considerations had contributed largely toward shaping existing methods, the matter lay to a certain extent beyond the reach of a purely rational treatment.

Nearly all these specifications require, first, that the web must be of sufficient thickness that the mean intensity of shear may not exceed a prescribed limit; second, that the bearing of flange rivets must not be greater than a specified unit value; and third, that the web thickness must not be less than a stated minimum.

Various standard values for allowable intensity of web shear were then given, the writer stating that the usual figure of 4,000 lbs. might, in his judgment, be safely doubled for a properly stiffened web, provided that the rivet bearing is kept within proper limits by the use of 6 x 6 flange angles with two lines of rivets, staggered. With regard to stiffeners, the greatest diversity of practice is again apparent.

The writer thinks that a limiting ratio of unsupported depth to thickness should always be specified, beyond which, even though the conditions of the formula are satisfied, stiffeners should be required, in order to insure the true vertical alignment of the web. This limit should not exceed 150, or perhaps it might better be restricted to 125. Regarding the proper size of stiffeners, there are, absolutely, no positive data available. Precedent, and that of a most varied kind, is our only guide.

In the design of the flanges, practice is much more harmonious. The writer believes that every specification should contain Mr. Cooper's excellent provision that at least half the flange area shall be of angles, or else the largest sizes must be used. In regard to unit flange stresses, 7,500 lbs. per square inch for live, and 15,000 lbs. for dead, stress is favored in proportioning the tensile flange; the compressive flange being made of the same gross section. Every specification should contain a clause to the effect that the compressive flange shall be stayed against lateral flexure at distances apart not exceeding 25 or 30 times its width. Within such limits, a constant unit stress may be safely used, instead of applying the modification of Gordon's formula frequently specified, which the writer believes to be wholly unreliable.

The thickness of flange metal should be strictly limited to four times the diameter of the rivets, for punched holes, and, in extreme cases of long shallow girders where this would not admit of flanges of the usual type, the holes should either be reamed or a different form of flange used.

The writer does not understand how, in the case of deck-girders, the common practice of neglecting the component due to the vertical loading in determining the bearing of flange rivets on web plates can be justified. If the uncertain element of friction between flange angles deserves recognition, it should be accorded rather through an increase in the allowable bearing intensity. It would seem advisable to specify in general that the pitch in the loaded flanges should not exceed four inches.

The writer favors the counting of one-eighth of the web section in each flange, rather than one-sixth, in order to make due allowance for rivets through stiffeners. The resisting movement of the web at splices should be developed rather by longitudinal plates attached to web directly within the flange angles than by outside cover plates.

The relative merits of the two types of girder have been made the subject of frequent discussions, but statements as to the span limits within which one type may be preferable do not convey sufficiently definite meaning unless qualified as to the contemplated loading. Assuming, as a mean value, that specified by the Pennsylvania Railroad—namely, two 10-ton engines followed by 4,000 lbs. per lineal foot—the writer holds that the use of lattice girders should not be permitted for spans below about 80 ft. for single track and 70 ft. for double track, supported by three girders. In case the matter of first cost is one of sufficient moment to apparently warrant the adoption of short span lattice girders, it should be considered that a better structure may be produced at essentially the same cost, in a plate-girder design, by relaxing somewhat the usual requirements specified for the latter.

DISCUSSION.

Mr. JAMES CHRISTIE: In the matter of the web, engineering experts have reduced its thickness almost to the condition of sheet iron, and have yet maintained good results. In some local instances we have webs only $\frac{1}{16}$ in. thick, with wide flanges, and the present mean value is about $\frac{1}{8}$ in. for thickness.

Mr. JOSEPH T. RICHARDS: After considerable experience in bridge inspection, I find that the web always gives out first, even in cases where the flanges are thinner.

Mr. JOHN BIRKINBINE: Mr. W. B. Riegner, in his paper on "The New Falls of Schuylkill Bridge," presented at the last meeting, Feb. 17, states that "the metal in the superstructure is wrought iron, no steel being used," and I have been told recently by a person who ought to know that one of our large railroads now requires all wrought iron, no steel being allowable.

Mr. A. W. BARNES: I think the Pennsylvania Railroad is the one insisting upon this; most of the others still allow steel I-beams.

Mr. Jos. T. RICHARDS: The manufacture and the use of steel are still in their infancy. It is coming in and iron is going out. Where the former is used it should be of good quality, and on account of the great variety of grades in which it is made we have found it difficult to get the best, and consequently do not consider steel to be reliable.

Mr. JAMES CHRISTIE: There is no doubt that the cheapening in its method of production has greatly extended the use of steel, but it must be remembered in considering the quality of the metal that the tests applied in these days are more critical than they were formerly, and the results on an absolute basis are undoubtedly better. I do not consider steel a fickle metal if it is properly made, as I believe it can be, and as tests can readily be applied to determine its quality, it would seem at least as reliable as iron.

Mr. Jos. T. RICHARDS: If we look at the history of bridges, we notice that stone and timber constructions are old and proved reliable. Iron became the fashion, and then considerable time was spent on the form of the truss, many engineers adopting special forms for their own practice. Then followed the economy craze, which

resulted in a good deal of trouble. England was the first to pronounce steel the best metal, and built the Forth Bridge entirely of this metal. They had considerable trouble, however, in getting the best quality. For example, one of the plates split while being unloaded before it was put into the structure. It was found that in shearing the edges they had been unequally strained, and this had caused the break. It has also been observed that in straightening out steel wire that had been coiled warm, it was very brittle and broke readily. These are a few of the many instances which make me consider steel a fickle metal.

Mr. GEORGE B. ROBERTS: Regarding what has been said respecting the relative merits of iron and steel, may interest you to know that the rails for the old Portage road were made in England, and were ordered of short lengths, so as to go around curves without bending, which it was feared would cause them to break. And these were iron rails. Steel, in its manufacture, is in the first place iron, which must be of good quality if the finished product is to be reliable. I think it is a fact, however, that in the past greater care has been exercised in the manufacture of iron than is now given to the manufacture of steel.

For bridge construction, the railroads that can afford it are going back again to stone construction, and, indeed, some of them are very seriously considering the use of wood for bridges. There is still in use, on a portion of the Pennsylvania Railroad system, one old wooden bridge, which has been standing for a great many years.

Standard Drawings for Car Work.

[WITH AN INSET]

In getting out three editions of the Car Builders' Dictionary, as well as in the current work of weekly publication, the *Railroad Gazette* has had quite an unusual experience in the study of drawings of railroad cars, and it would be astonishing to many to know how incomplete such drawings frequently, if not usually, are. It is often necessary to supplement the drawings received by correspondence, photographs or personal inspection to ascertain facts and dimensions that should be obvious on the drawings. In fact, it would be difficult for a car builder to select a set of drawings out of half of those sent to us from which he could actually build a car. Probably it is not too much to say that half of those drawings which we receive do not give information enough for an intelligent bid, much less enough to build from.

We have pleasure in showing as a contrast the drawings which appear on the inset published herewith and which are reproduced almost exactly as they were received. The lettering was enlarged for reproduction by photography and in the interior end view, fig. 4, the seats were shaded by the draughtsmen before photographing, being in the original left white with the corners slightly shaded. A few dimensions and instructions have been omitted in the engraving to prevent crowding or reduction. A study of these drawings will show them to contain all the information necessary for making out bills of material, writing specifications and for the complete erection of a car.

A few of the large railroad companies make it a practice to finish drawings sent out for carbuiding in great detail. Among these may be named the Erie, the Lake Shore, the New York Central, the Norfolk & Western, the Pennsylvania and a few others.

From the drawings published herewith it may be seen that the details were considered at great length and with much care before the specifications were written or contract let. The brass furnishings, seats, lights, heaters, decorations and all the minor details have been carefully worked out, and what is shown on this one sheet is often given no better in several large sheets comprising general plans and full sized details. The original size of the blue-print from which this engraving is made is 34 x 58 in., which is a very common size in the car drawings of several of the large roads in the Eastern and Middle States.

The Liverpool Overhead Railway.

A shareholders' meeting of this company was held Feb. 13, and the first half year's report of working was submitted. This line is the only elevated city passenger railroad in England. The total length authorized is 7 miles and 5 chains, of which 5 miles and 68 chains is built, and 5 miles and 12 chains was operated during the half year reported on, ending Dec. 31, 1893. The passenger train mileage was 243,539, and the total passengers carried were two and a half millions; being, first-class, 260,000; second class, 1,294,000, and workmen on special return tickets, 922,000. The average load (computed) was about 50 per train, the total capacity of each train being 114 passengers seated.

The report states that 95 per cent. of the trains were punctual on a five minutes headway, which incidentally speaks well for the automatic electric signal.

The gross revenue for the half year was £18,514, and working expenses £13,773, or 74 per cent. After paying interest there was available for dividends sufficient to pay five per cent. on the preference shares and one per cent. on the ordinary. This result for the first full half year seems very satisfactory. The cost of locomotive power was undertaken by the electrical contractors, who equipped the line, at four pence per train mile; but the directors took over the whole equipment from the first of January, 1894, and expect to save money.

A very careful account of the equipment and operation, with financial results will be found in the papers by Messrs. Greathead, Fox and Parker, which are published in abstract on another page.

* See Mr. Parker's paper on another page.

Coal Production in 1893.

The *Engineering and Mining Journal* publishes the following table of the coal production in the United States for the last calendar year, the figures being in nearly every case from state officials or other local authority. They have been collected for the forthcoming volume of "The Mineral Industry."

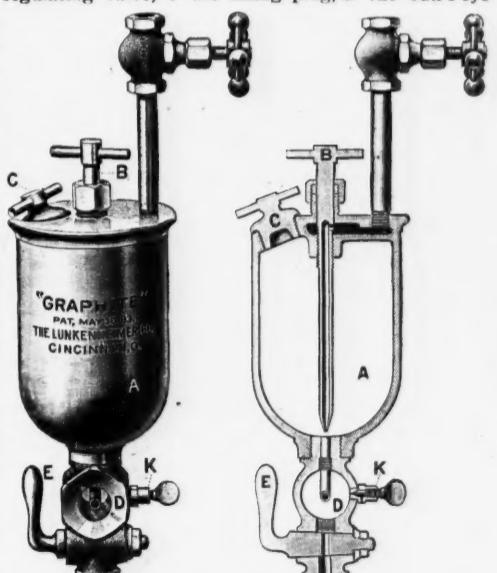
	Tons of 2,000 lbs.	1892.	1893.
Alabama	5,314,227	5,170,042	
Arkansas	739,300	750,000	
California	131,431	167,219	
Colorado	3,771,234	3,947,056	
North Dakota	240,000	325,100	
Georgia	165,000	372,191	
Indiana	4,494,811	4,583,000	
Indian Territory	1,004,765	1,224,562	
Illinois	17,949,989	18,955,000	
Kansas	3,820,000	3,790,000	
Kentucky	2,794,000	3,089,300	
Maryland	3,020,050	3,290,032	
Michigan	3,036,283	3,727,079	
Montana	70,000	75,000	
New Mexico	434,291	457,045	
Ohio	14,599,908	14,521,800	
Oregon	34,720	56,000	
Pennsylvania:			
Bituminous	46,576,576	45,225,881	
Anthracite	52,472,504	53,810,214	
Tennessee	2,413,678	1,857,452	
Texas	300,000	322,745	
Utah	363,020	416,605	
Virginia	800,000	812,953	
West Virginia	8,710,878	8,891,323	
Washington	1,000,000	1,211,550	
Wyoming	2,454,449	2,243,401	
North Carolina	6,417	17,000	
Nebraska	1,500	2,000	
Rhode Island	14,000	14,000	
Total production	180,399,017	183,422,710	
Imports	1,281,839	1,241,028	
Total supply	181,680,856	184,663,733	
Exports	2,997,004	4,097,943	
Consumption	178,683,852	180,565,795	

The export trade has increased about 36 per cent. The small decrease of production in Alabama is considered remarkable in view of the decline of 20 per cent. of pig iron production there. This is due in part to exports to Mexico and the West Indies. The greatest decline is in Tennessee, 27 per cent.

Figures have been given out by the *Coal Trade Journal*—which publishes an annual handbook, "The Coal Trade"—which differ somewhat from the foregoing. The total production is given as 167,133,062 gross tons, which is equal to 187,188,960 net tons, or about 4,000,000 tons more than the total given by the *Engineering and Mining Journal*. The discrepancies in the figures of different states are in some cases very large, however, from which it would appear that they were made up on some different basis. The production of anthracite, for instance, is very much smaller in the *Coal Trade Journal's* figures, indicating, perhaps, that in the other table the coal consumed at and about the mines was included.

Lunkenheimer's Patent Graphite Sight-Feed Lubricator.

The engravings show the latest thing in sight-feed lubricators, which is to supply pure flake graphite to the steam chests and cylinders of engines and pumps. The graphite is fed dry in desired quantities, automatically and through a sight-feed. The operation of the lubricator is readily understood from the engravings.



Graphite Sight-Feed Lubricator.
sight-feed chamber, *E* the feed-regulating valve, and *K* a drain valve. The operation is nearly the same as that of a sight-feed oil lubricator, the graphite being sucked from the reservoir, *A*, through the tube, *D*, by the passage of steam through the ejector shown. No sight-feed oil lubricator is required where this cup is provided, but the manufacturers recommend that one be used in connection with it. The list prices vary from \$5 to \$9, and they are made in three sizes, with capacities of three, five and eight ounces. They are finished in brass or nickel, and the Lunkenheimer Company, of Cincinnati, O., are the patentees and manufacturers.



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Published Every Friday.
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

February earnings, as shown in the table for 123 railroads compiled by the *Commercial and Financial Chronicle*, followed the same course as January earnings. The report has all the roads for both months, which is unusual, and in February their average earnings per mile fell from \$396 in 1893 to \$338 this year, a decrease of \$58, or 14.65 per cent.; in January from \$430 to \$367, a decrease of \$63, or 14.65 per cent. also. For many of the roads the earnings were given for only three weeks of February in either year, which accounts for the earnings being so much smaller in February than in January, but probably had no effect on the rate of decrease. Of the 123 roads no less than 118 had a decrease of earnings in February, and 117 in January. This average decrease is very large. There was an increase in mileage of 2½ per cent., and the decrease in total earnings was about 12½ per cent. in both months. The Canadian and Mexican railroads in the list have 13,192 miles of road, and the other 82,753 miles is not quite half the total in operation in the United States. A larger number of railroads have reported by this time in previous years, but not so large a mileage. There was a decrease in February also last year, the 130 roads then reporting having earned an average of \$419 per mile in 1892, against \$396 in 1893, but for the two months there was an increase. In 1892 the increase in average earnings per mile was from \$374 to \$419; in 1891, from \$371 to \$375; in 1890, from \$342 to \$371. The decrease last year was largely due to unfavorable weather.

The importance of the American Line from New York to Southampton as a competitor for passenger traffic is obvious at a glance and is well recognized by the lines running to Liverpool. More doubt has been felt as to the success of this line in getting freight. There is one class of freight, however, which it would seem might be very largely diverted to this route; that is, the provision traffic. London with its five millions of people furnishes the greatest provision market in the world, and the rail haul from Southampton to London is so short that all that is needed is favorable rates and good facilities to attract a great trade to this line. The London & South Western has done many things to make the line a success as a passenger and freight route for traffic in both directions; but one of the neatest things that it has done is its arrangement for the delivery of dressed beef. It makes up a special train of the ordinary, open, goods trucks carrying delivery wagons. A 4-wheel truck carries one wagon and a 6-wheel truck carries two. These are ordinary wagons covered with tarpaulins. The train is run alongside the ship on the dock, the carcasses are loaded into the wagons, and then the train is taken right away to London on quick time. On arrival in London the wagons are run off, horses hitched to them and the beef is delivered immediately to the consignees, butchers, marketmen and so on. The handling is thus reduced to a minimum, as also is the time of transit. This makes rather an expensive train regarded simply as a train, the carrying

capacity being small in proportion to the dead weight and cost of the rolling stock, the delivery wagons being considered as part of the rolling stock. But the directness, convenience and quickness of the whole operation probably permit the company to carry the meat at rates at least as low as those charged by anybody else, with quite as much profit as anybody else would get. The only enterprise at all analogous to this that we know of in the United States is that of the Long Island Railroad in bringing market wagons from the truck farms into Long Island City. In this case, however, the wagons are part of the plant of the shipper and not of the railroad company.

It is a good thing that the directors of the Pennsylvania Railroad have averted, in their annual report, to the increasing danger which the public is imposing upon itself by permitting the establishment of electric street railroads across standard railroads on which heavy trains are run at high speed. The Pennsylvania directors are very moderate in their complaint, and an impartial critic might reasonably put the case much stronger. The directors say:

It must be borne in mind that the entire movement on these electric railways is in the transportation of passengers, and that therefore the risk to life and limb from such crossings, owing to the frequent service, is proportionately much greater than on the steam railroads where the trains are not nearly so frequent, and where the movement is made up largely of freight traffic. It would hardly seem reasonable that the electric railways should be permitted to indefinitely increase the number of these crossings, while at the same time your company and the city of Philadelphia are expending over \$400,000 to remove the grade crossing of your road by the North Pennsylvania Railroad in the northern portion of the city. [The city pays a part because streets are involved].

In other words, if we eliminate the freight trains we find that the vast numbers of people who travel on the steam railroads are carried in a small number of trains. If the same number went by street cars, they would be distributed among perhaps five or ten times as many trains. This increase in the frequency of trains is, indeed, a principal element in the value of the street line. But with the frequency of the street service—the division of the total number of passengers into a large number of small loads—the freight trains become a serious element of danger, for the more trips an electric car makes across a steam railroad at grade the more chances does it take of being run into by a freight train. And whichever kind of steam road train the street car encounters at a crossing, much the larger risk of injury is borne by the street car. The general disposition all over the country to encourage electric roads may be looked upon as a movement of the public to get cheaper rides at more convenient intervals, at the expense of comfort and safety. The lack of suitable warmth, of ample seats and smooth riding, does not concern us just now, but the high speed, endangering persons both inside and outside the cars, which has been very common, and the willingness of the companies to cross railroads at grades rather than make a larger investment, call for a general protest. It is true that individuals take these risks with their eyes open, but as in the case of steam railroads, the law will probably require the carrier, finally, to protect people from the consequences of their own carelessness, whether the people desire it or not.

The Massachusetts Railroad Commissioners, in their last annual report, criticize the management of the electric roads of that state, and their utterances, as published in the daily papers, met with some remonstrance, it being thought that they condemned the principle of electric motive power in a wholesale manner. The full report, which has now come to hand, does not bear out this view. The paragraphs referred to are simply a warning against overcapitalization. The Commissioners say:

The electric system has not shown or indicated any such margin of profit as to justify the expectation of more than moderate and ordinary returns on money legitimately invested in it. The idea, which seems to have obtained some currency, that the electric railway system is a bonanza of rare and inexhaustible wealth is clearly a delusion, and has doubtless proved to some a snare. The absolute cost and expensiveness of the system, under the most conservative, able and honest management, are sufficient to task its earning capacity to the full limit. There is no margin for fictitious or inflated capitalization. It presents no safe or inviting field for speculative enterprise or manipulation, unless it be to the unscrupulous operators of an inside ring who are willing to practice on the credulity of a misinformed public.

They might have added that wherever there is a very large margin for profit the public will demand a reduction of fares. And the owners of the railroads may rest assured that, generally speaking, the public will reduce excessive profits, by encouraging competitive lines if no better way is available. It behooves a company that has "a good thing" to give good service in return. The Commissioners give figures to justify

their conclusions, from which we extract the following:

STREET RAILROADS IN MASSACHUSETTS.

	1888.	1893.
Number of companies.....	46	60
Total length of lines, miles.....	534	874
Of which the number of miles operated by electricity was.....	0	711
Capital stock.....	\$10,894,850	\$25,883,575
Net debt.....	6,342,231	20,767,103
Dividends.....	625,017	1,716,627
Percentage of same on stock.....	5.74	6.63
Net income.....	\$785,008	\$1,993,399
Gross assets.....	19,206,656	50,130,273
Gross liabilities.....	18,461,101	49,589,688
Surplus.....	742,555	540,585
Percentage of surplus to capital.....	6.82	2.09
Passengers carried.....	134,478,319	213,552,008
Average pass. per round trip.....	42	45
Gross earnings.....	\$6,824,317	\$10,832,174
Operating expenses.....	5,532,797	7,501,845
Percentage of expenses.....	81.07	69.26
Net earnings per pass., cents.....	0.96	1.56
per car mile.....	5.66	9.65
per round trip.....	40	74
per mile of road.....	\$2,420	\$3,810
Cost of road per mile.....	33,695	53,986
Capitalization per mile.....	32,304	53,367

It will be seen that while net earnings have increased in five years 57 per cent., the cost of road has increased 60 per cent. and capitalization 65 per cent. The surplus of 2.09 per cent., as compared with 1888, also indicates the general tendency to sail too close to the wind; and the surplus in 1888, when the companies evidently were preparing to enlarge their operations, though no electric lines had begun running, was less than half what it was in each of the four preceding years. The roads have evidently capitalized their expectations fully up to the limit of prudence. While the figures published do not show evidence of recklessness, they furnish a plain warning. The fact that in the past year the increase in bonded indebtedness has been twice as great as the increase in capital stock emphasizes this warning. Six companies having \$2,575,000 stock have \$5,115,500 bonds outstanding. The electric roads being all new, their expenses for repairs are now at the minimum, so that the low percentage of expenses to earnings must not be implicitly accepted as an indication of economical management. And in comparing the earnings per car-mile and per round trip between 1888 and 1893 it must be remembered that the cars have been increased in size, and that the number of cars in a train, which in 1888 was one, is now, in many cases, two or more. Increasing the size of cars is a very great gain, because more passengers are carried for the same expenditure of wages, but it is not quite a clear gain, of course.

The Interstate Commerce Law.

In the House of Representatives at Washington, last Tuesday, a motion by Mr. Morse, of Massachusetts, to strike out from the Sundry Civil Bill the entire appropriation for the support of the Interstate Commerce Commission gave rise to an animated discussion of the effect of the recent decision of Judge Grosscup at Chicago. Mr. Daniels, of New York, said that it was unauthorized and in opposition to the declaration of the Supreme Court on the subject. Mr. Morse's motion received but five votes, and it was very likely offered chiefly to bother the other side of the house, but it is of interest as showing that even political bickerings may sometimes arouse intelligent discussion. A clause in the appropriation bill giving the Commission more power to employ counsel was agreed to by the House.

It is unfortunate that Judge Grosscup's decision should be so generally regarded as deciding vital points in connection with the Interstate Commerce Law, for it really does nothing more than emphasize what was well known before, that the Commissioners must detect lawbreaking by the same means that other prosecuting officers do. The judge simply holds that witnesses cannot be compelled to testify against themselves as to cut-rate discriminations. Difficulties which arose continually under the fifth amendment of the constitution at last caused the passage of the act of Feb. 11, 1893, for the previous statute, which limited, in certain cases, the right to refuse testimony, had been declared void by the Supreme Court in the Counselman case. The act of 1893 was an attempt to correct the situation under the constitution, by absolving the witness from prosecution in any event, and in its final form applied to all criminal proceedings under the interstate commerce law. In denying the right of the district attorney to commit the railroad agents, in this case, for contempt of court, Judge Grosscup held that the statute of 1893 was in the nature of an immunity or pardon, and that the rights of the witness under the fifth amendment of the constitution are not taken away by this statute. The witnesses may prefer not to accept this immunity, but to stand on their constitutional rights. This practically declares the statute invalid, and the decision will probably be upheld when the question comes before the Supreme Court of the United States.

The Commission is simply forced back to the for me

ACCOMPANYING THE RAILROAD GAZETTE, MARCH 16, 1894.

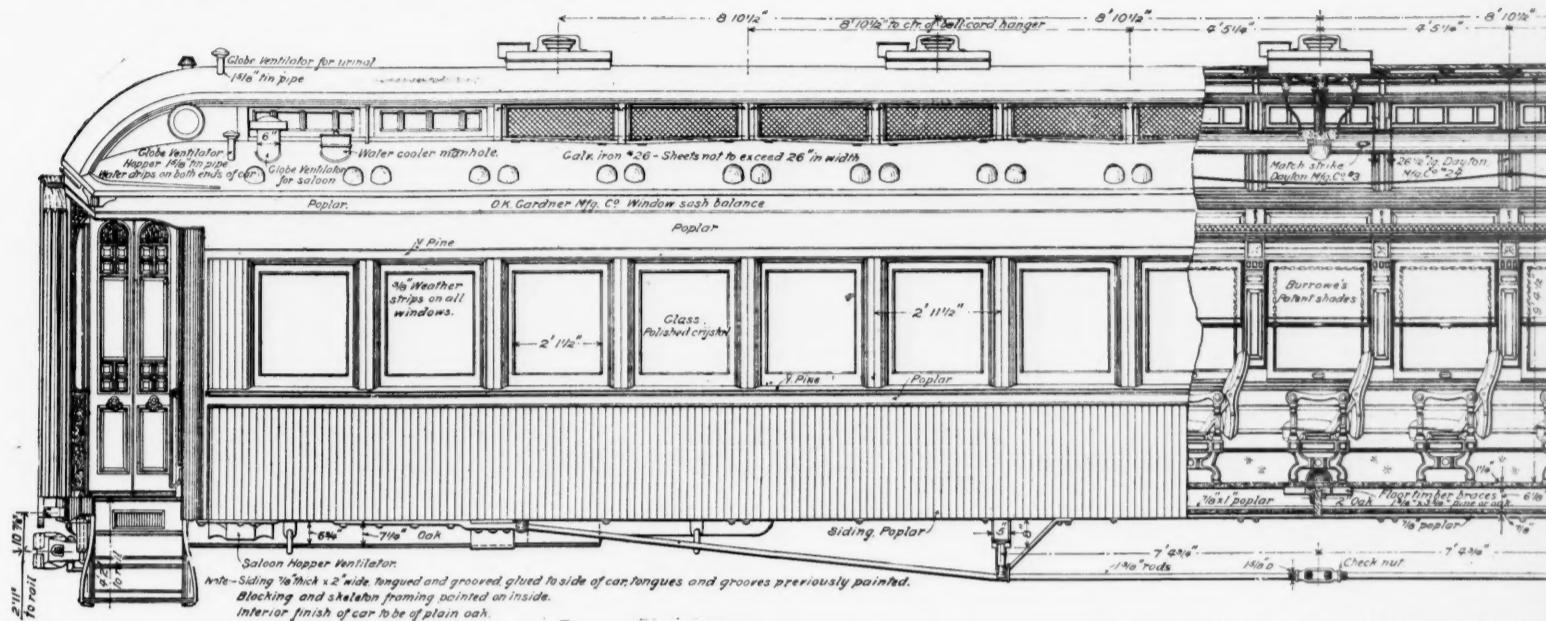


Fig. 1—Side Elevation and Section Showing Interior.

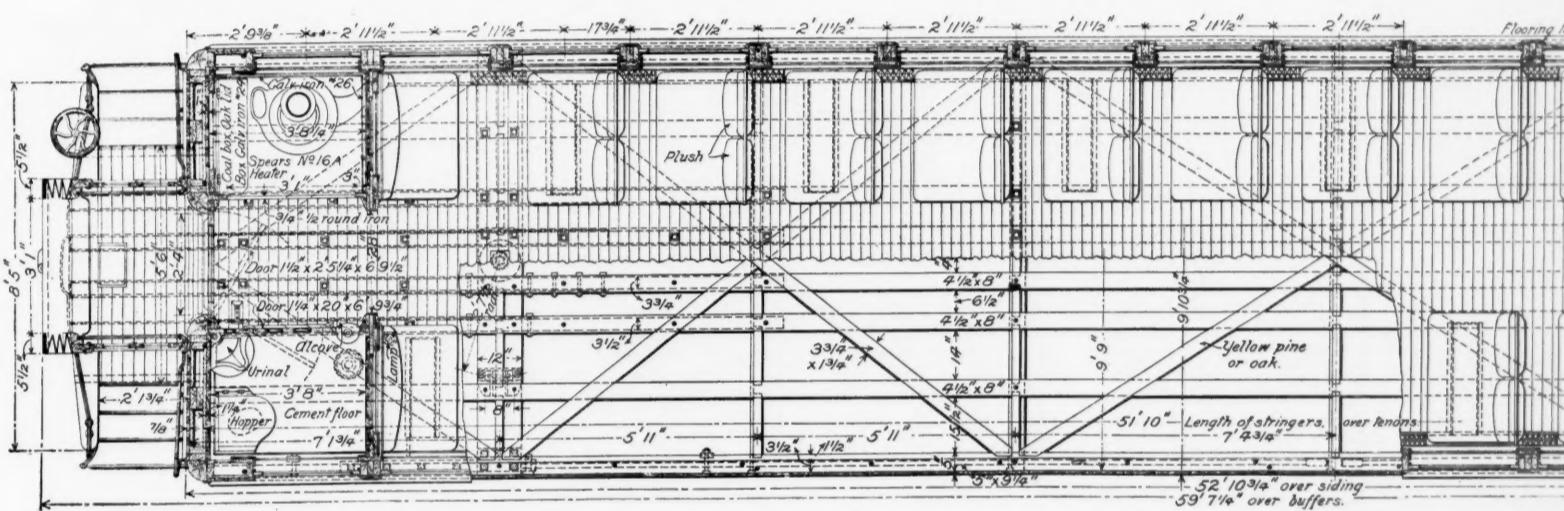


Fig. 2—Plan of Car and Section Showing Underframing

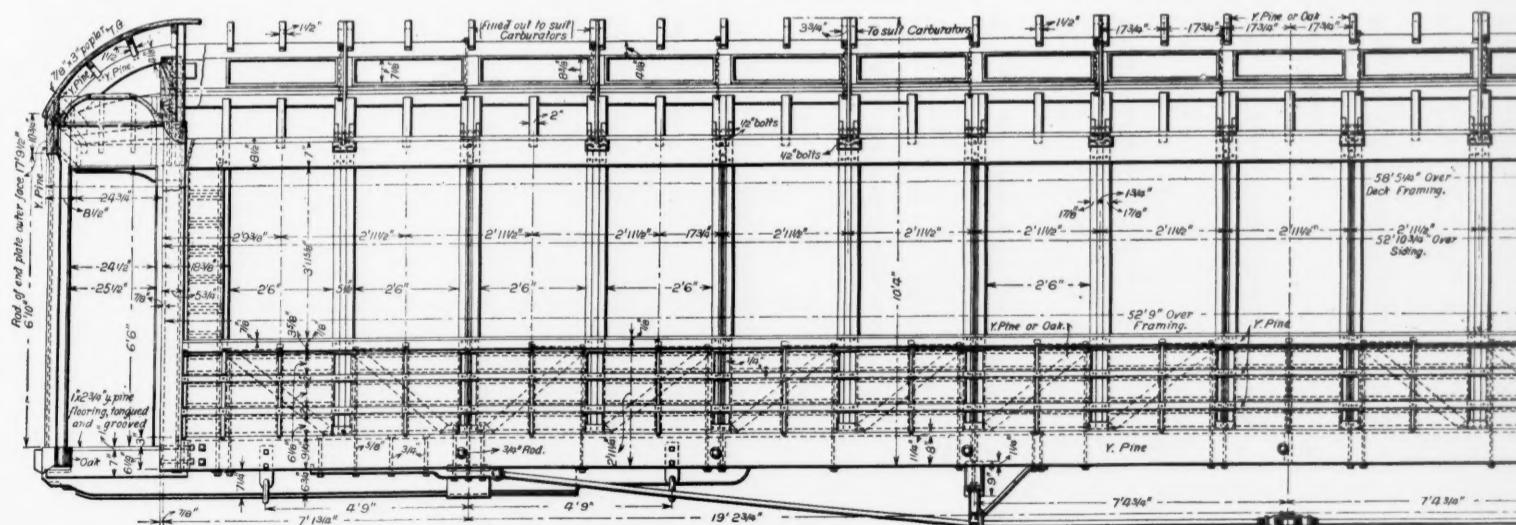


Fig. 3—Side Elevation of Car Framing.

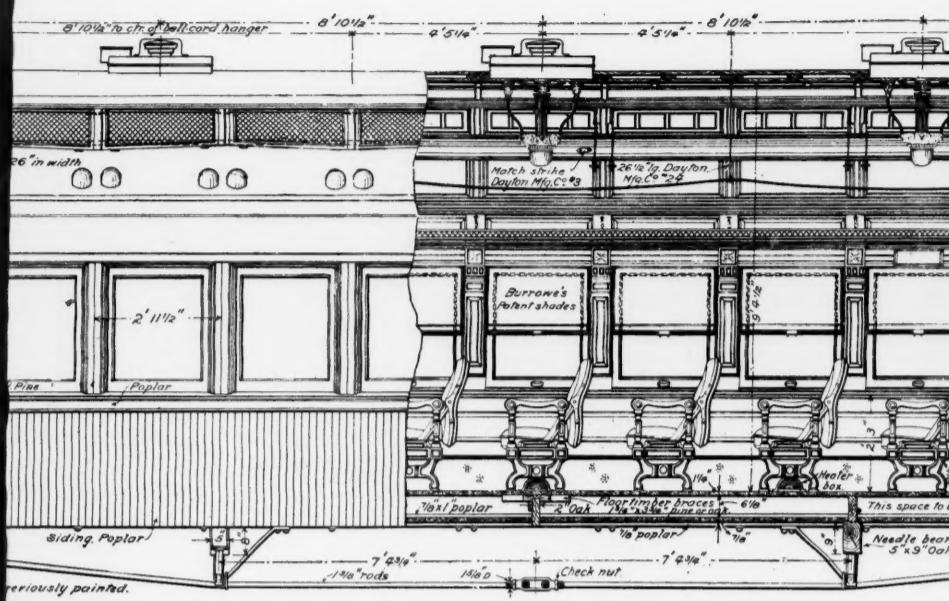


Fig. 1—Side Elevation and Section Showing Interior.

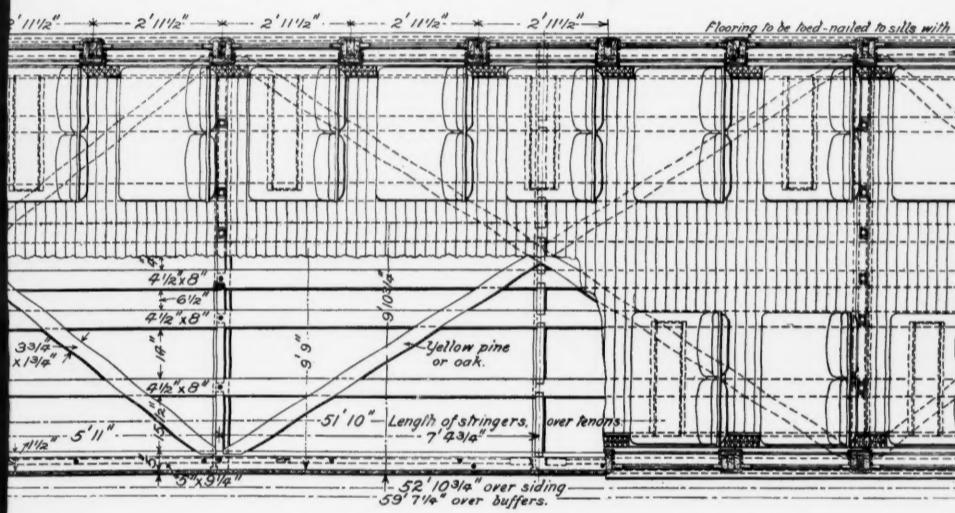


Fig. 2—Plan of Car and Section Showing Underframing.

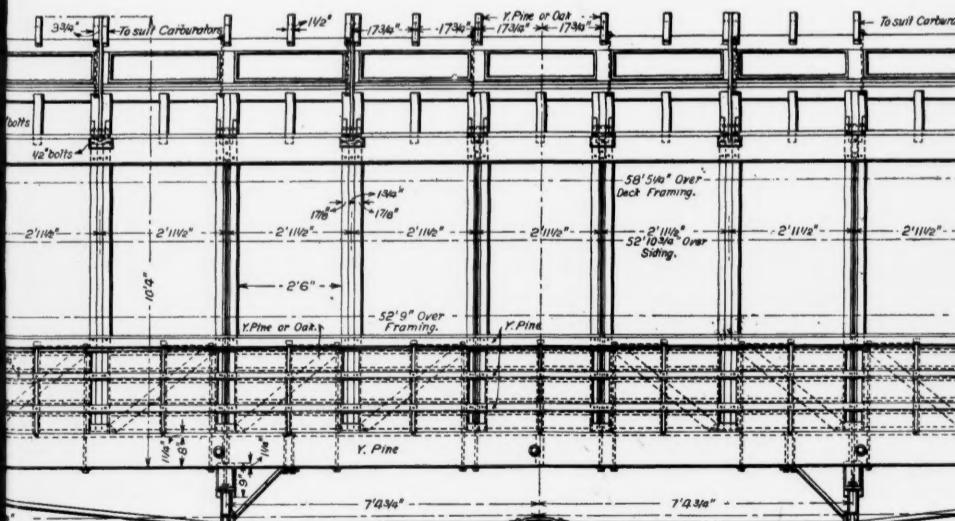


Fig. 3—Side Elevation of Car Framing.

STANDARD DRAWINGS FOR CAR WORK—NORFOLK & WESTERN RAILROAD.

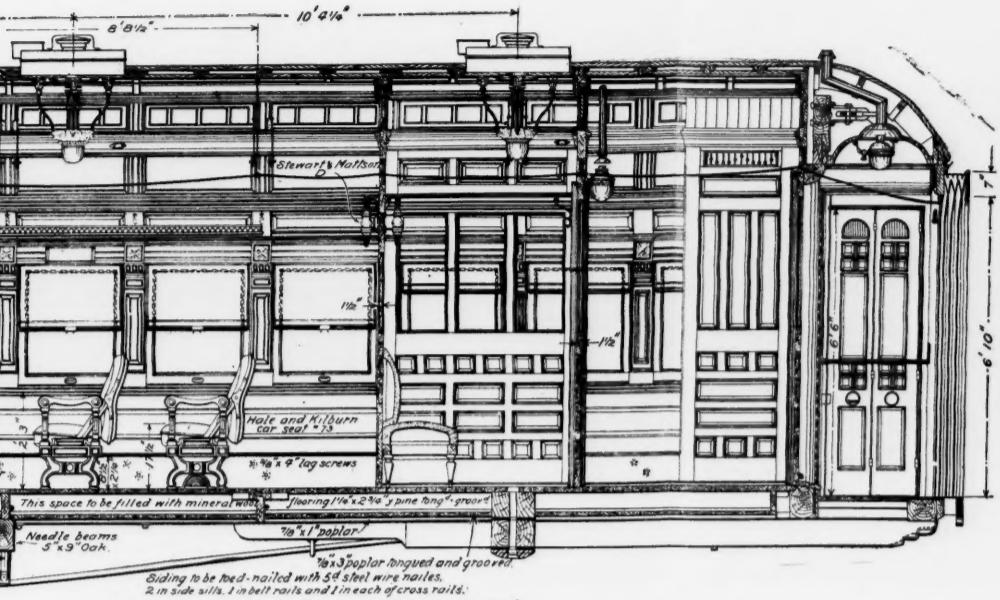


Fig. 4—End Elevation of Interior.

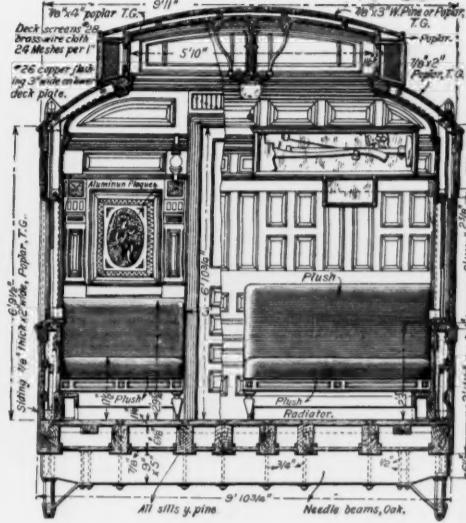
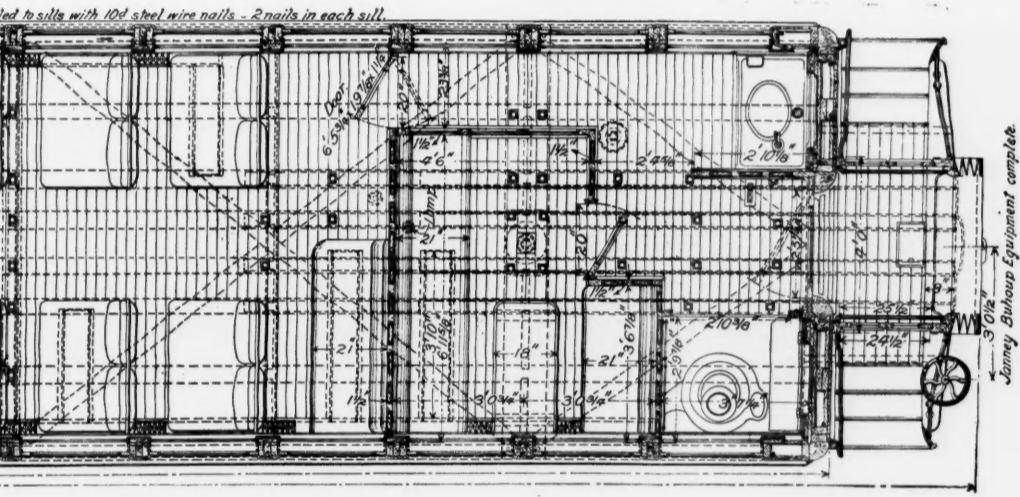


Fig. 4—End Elevation of Interior.



Janney Buhoup Equipment complete.

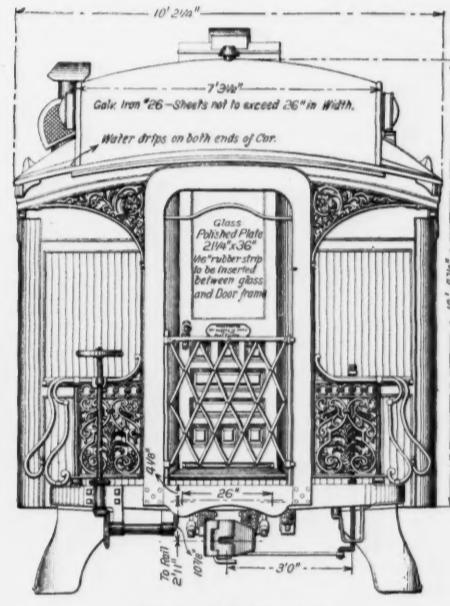


Fig. 5—End Elevation.

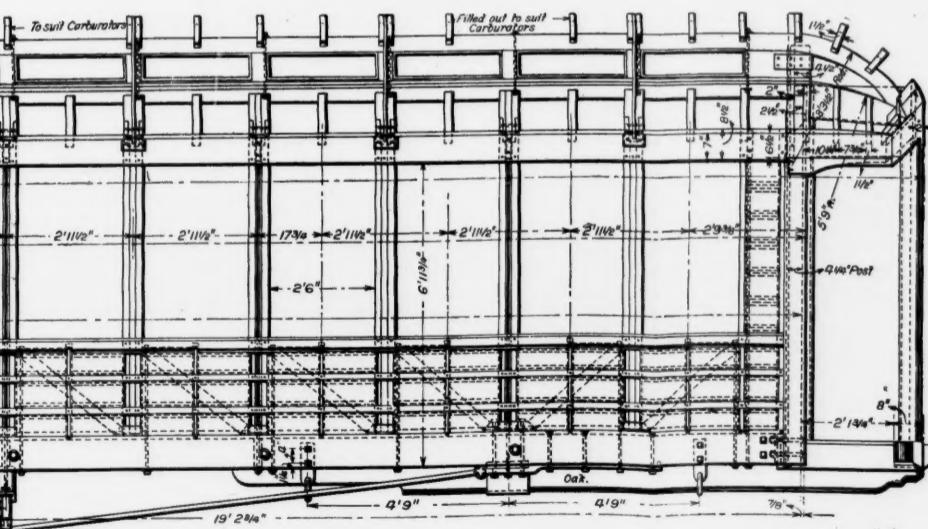
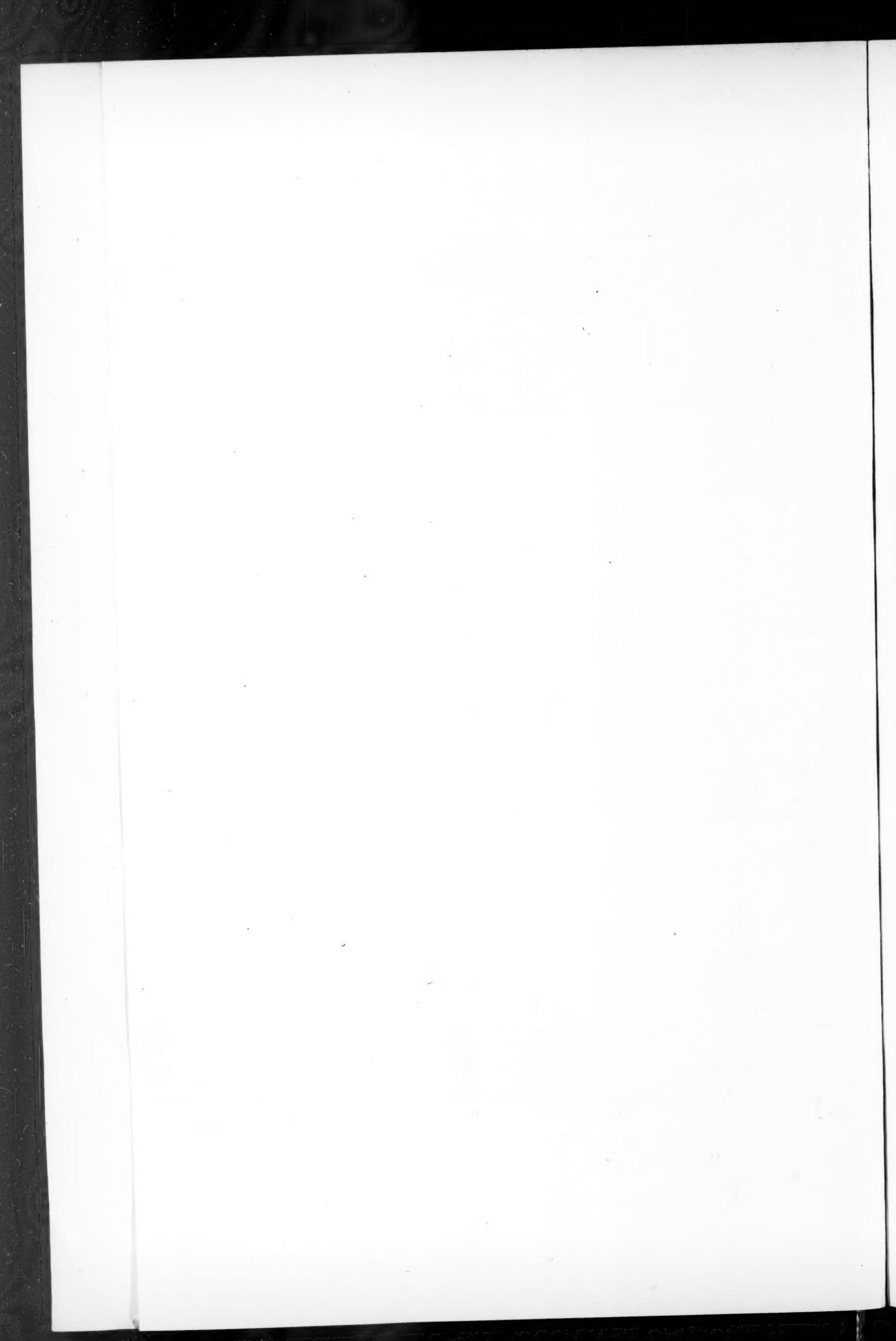


Fig. 6—Transverse Sections

MR. R. H. SOULE, *Superintendent of Motive Power.*



course of relying wholly on the testimony of witnesses who have not been partakers in the offense. The case merely brings very forcibly to our attention the fact that a vast number of discriminations and like abuses are practised all the time, and that, under the present situation, it is a matter of the greatest difficulty to uncover these violations of the law. But certain weaknesses in our present legislation which are indirectly made clearer by this decision should now be patent to every one.

In the first place, it is evident that class feeling or common interest among railroad agents will always prove strong enough to withhold necessary testimony. This fact shows the mistake of the Interstate law, which makes the subordinate agent technically the guilty party, and his imprisonment the punishment for the offense of the railroad. On the contrary, the agent is in fact not ordinarily the responsible party, for he is only carrying out the orders of his superiors. The punishment for the offense should rest on the corporation, not on its subordinate officials. The criminal clauses of the law have, in just such cases as the present, indirectly checked the usefulness of the whole law. If these clauses were changed, and heavy fines imposed on the corporations as punishment for violations, very likely the law would be enforced in a large number of cases, where it fails now.

A serious fundamental weakness in the law, well known heretofore, is again indirectly brought to view by such cases as the present; we mean the sections which deal with competition. The great number of secret violations which are going on continually in competitive traffic, are inevitable as the result of commercial forces. We have, at present, the wholly illogical situation, that all arrangements between carriers, in regard to rates, are forbidden, while departure from published tariffs is a criminal offense. The law forbids the evils of rate-cutting, but strikes out the only way of checking fierce competition, which is their cause, by making pooling illegal. For the future effectiveness of the law this clause should be repealed. It is evident now, as it was not to the framers of the law, that the true way to solve the central problem of railroad discriminations in rates is to make the law sound commercially—one which will apply to the industrial situation. As it stands, these evils are tremendously encouraged by the prohibition of pooling, and their detection is made well nigh impossible by the criminal clauses of the law. As Mr. Walker said at Chicago, the law requires both sharp competition and steadiness of rates, which is an impossible combination.

White Pine Lumber in 1893.

The very full statistics of the production of white pine lumber published in the *Northwestern Lumberman* show that compared with the previous year there was a decrease in 1893 of 1,303 millions of feet (14½ per cent.). The 1892 production, however, was 960 millions greater than in 1891 and the largest ever known. The total production is given by the *Lumberman* for each district for the last 21 years. From 1873 to 1878 it decreased from 3,994 to 3,629 millions, averaging 3,803 millions yearly for the six years. From 1878 to 1879 the production increased one-third, and continued to increase rapidly until it reached 7,552 millions in 1882, since which time it has not always grown, but has varied from year to year with the circumstances, going up to 7,935 millions in 1884, and falling to 7,053 the next year; since which time it has been, in millions of feet:

1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
7,425	7,753	8,389	8,396	8,665	7,943	8,903	7,600

The production last year is the smallest since 1886, but was only exceeded twice before 1886. The very large production of 1892 doubtless had considerable effect on the output last year, as well as the hard times.

The *Lumberman* gives statistics of the stocks on hand at the mills at the close of the year, from which we may ascertain the consumption of each year counting as consumed, however, the quantities in dealer's yards, which form an enormous aggregate. The stocks increased from 3,119 to 3,646 millions during 1893, leaving as consumed only 7,073 millions last year, against 9,122 in 1892, a decrease of no less than 2,049 millions, or 22½ per cent.

The weight of the lumber produced last year was probably not less than 18,800,000 tons, and as much of it is carried great distances it will be seen that it is an important article of freight.

The decrease in production was 16 per cent. in the Saginaw Valley, and 42 per cent. on the Lake Huron shore, which together produced 18 per cent. of the total supply in 1892 and only 11.3 per cent. of it last year; but the decrease was pretty uniform in the other great producing districts, the newest, including all of the Wisconsin and Minnesota production, except on

Green Bay, falling off 12.9 per cent., while the districts which market chiefly at Chicago, including all the Lake Michigan and Green Bay mills and some on Lake Superior—one of the oldest districts—lost 13.1 per cent., and the interior mills of the lower peninsula of Michigan, which reached their maximum as long ago as 1892, yielded but 12 per cent. less than in 1892 (though 38 per cent. less than in 1882). There are evidently a good many pine trees left accessible to old mills, though every year represents substantially the harvest of a crop that has required more than a hundred years to mature. Some places seem nearly ready to disappear from the list, however. Muskegon, which turned out 662 millions in 1881, and more than 600 millions every year but one afterward until 1889, is credited with but 131 millions last year, against 254 the year before. The Chicago & West Michigan Railroad mills decreased 45 per cent. from 1892; the Mackinaw Division of the Michigan Central 43 per cent.

The Wisconsin railroad mills generally maintained their production fairly well, the Milwaukee, Lake Shore & Western mills losing 21½ per cent., it is true, yet producing more than in any year before 1892, while the decrease by mills on other lines was: Wisconsin Central, 15½ per cent.; Wisconsin Valley, 22; St. Paul & Omaha, 11 per cent. At the Mississippi River mills the decrease was 12½ per cent. They produce more than all the Wisconsin railroad mills together.

The production of shingles, which, to a great extent, are a by-product of lumber, fell from 4,280 millions in 1892 to 3,421 in 1893, a decrease of 20 per cent.

The Suakim-Berber Railroad.

In the *Railroad Gazette* of Feb. 9 appeared the statement that a man in Canada had received a contract for supplying ties and building material for the Suakim-Berber Railroad. There are two reasons why the "copy" for this item should have been thrown into the waste basket instead of having been embalmed in the pages of the *Railroad Gazette*. First, it is highly improbable that anybody will ever furnish wooden ties for that railroad, and presumably a Canadian contract would be for wooden ties. If the railroad is ever built, the ties must be of iron, for white ants would destroy wooden ties. It has been suggested that this might be prevented by creosoting them, but we are informed that creosote stimulates the appetite and improves the digestion of the white ant. Second, the railroad is still entirely in the air and the country through which it must be built is occupied by hostile tribes. There is, however, a certain interest in England at this moment in promoting its building. This interest is especially strong in Manchester, where, anything that leads to the opening up of new fields for trade is welcome.

On Feb. 21 a special meeting of the Manchester Geographical Society was held to listen to a lecture on the subject by Col. C. M. Watson, of the Royal Engineers, for several years a Pasha in the Egyptian Army and Governor of Suakim, and to a talk by the editor of the *Railroad Gazette* on this subject. It happens that the editor was the first man to suggest the railroad so far as any available records show, he having made a reconnaissance of the route and having sent a barometric profile, a plan and a report, urging the building of this railroad, to the War Office in Cairo several years before the Mahdi's rebellion. He claims no credit, however, for having suggested such a railroad; Herodotus himself probably would have suggested it if he had ever heard of railroads, for it was as obvious as the nose on a man's face. It is not too much to say that if this railroad had been built the Mahdi's rebellion would never have taken place, or if it had taken place it would have been crushed in its beginning, and in all human probability Gordon would now be alive. It was gratifying to hear so eminent an authority on the subject as Colonel Watson say this, for it is an opinion that we have long held.

Before the Mahdi's rebellion the Khedive had spent a good deal of money toward the building of what was known as the Soudan Railway which was to start from Wady Halfa and to go to Khartoum, a distance of 500 miles, necessitating two bridges or ferries across the Nile. Northward from Wady Halfa the route would be continued by steamers on the Nile to Assouan, then traffic would be transferred to six miles of railroad around the first cataract, then by boat again to the

most southerly extension of the Egyptian railroad system, then by rail to Cairo or to Alexandria as the case might be. This involved a total distance of 1,400 miles from Khartoum to tidewater, with four transfers.

The Suakim-Berber railroad means only a railroad of 240 or 250 miles from Berber to Suakim, where the

freight from the Soudan would be put at once into deep water, Berber instead of Khartoum being the inland terminus. Or if Khartoum continued to be the Soudan trade center, the route would involve boats on the Nile from Khartoum to Berber, 220 miles, then one transhipment and 240 or 250 miles of railroad.

There never has been any serious commerce existing in the Soudan that would stand transportation by the former route. Ivory, ostrich feathers and possibly gum arabic would pay the necessary charges of such a costly route, but the quantity of such material to be brought out of the country would go a very little way indeed toward supporting a railroad. Such material as has been carried into the country by caravans would pay the highest rail and water charges that would ever be imposed by the longest route, but with such charges it would be impossible to build up a commerce that would support a railroad. As a military route the advantages also are entirely on the side of the Red Sea route—that is, by way of Suakim and Berber. For the transportation of any considerable force and supplying it by the Nile Valley route would be an extremely tedious process.

The advantages and disadvantages of the two lines for reaching the Soudan are so apparent that one may wonder why the Nile valley route was ever selected and why the suggestion of a Suakim-Berber railroad was never seriously considered by the Cairo Government. The secret is that the Khedive had no navy and was not permitted by the European powers to have a navy, and therefore did not want to put the door of the Soudan in a harbor on the Red Sea where it might be seized by any naval power. Rather than take this risk he chose the impossible Nile valley route. We say impossible because the finances of the country could never have stood the burden of building and operating for strategic purposes a line in the nature of things unprofitable.

All of this is now ancient history, but to a good many Englishmen it has a live interest to-day, and it is not at all impossible that within a very few years the Suakim-Berber project will be seriously taken up. It is the opinion of good judges that the temper of the tribes in the desert between the Red Sea and the Nile is such to-day that they would welcome anybody who came with the purpose and the power to deliver them from the government of the successors of the Mahdi, and it is quite possible that a very small military force would be required to protect the surveyors and the end of the line; and the line once built, the present Bedouin government, which is practically one of oppression and anarchy, would probably go to pieces very quickly.

The Freight Rate Trouble in the South.

The members of the Southern Railway & Steamship Association held a meeting in New York City on Tuesday of this week to consider the difficulties which have culminated in the notice of the Louisville & Nashville, dated Feb. 13, withdrawing from the Association. No result had been reached when this paper went to press, but a committee of five prominent railroad officers headed by Col. H. S. Haines was appointed to present a basis for arbitrating the questions at issue.

The letter from President M. H. Smith withdrawing from the Association was very sharp, not to say savage, and was aimed particularly at the Cincinnati, New Orleans & Texas Pacific and its Receiver. This road, with its controlled line, the Louisville Southern, and its southern connections, the Alabama Great Southern and the New Orleans & Northeastern, competes with the Louisville & Nashville at most of its important stations. Mr. Smith says that the Louisville & Nashville has pursued an honest policy for the last 25 years, while its competitors have systematically cut rates, generally just enough to get some of the traffic without provoking the Louisville & Nashville to an open reduction; but lately competitors have become so bold that radical action is necessary. Mr. Smith recognizes that a clause of the agreement binds him to remain in the Association until next July, but he says that the clause requiring rates to be maintained is so much more important that in the present situation the former is entirely overshadowed. He gives statistics for the last half of 1893, compared with the last half of 1892, of all the traffic from Western gateways to the territory south of the Memphis & Charleston and east of the Mobile & Ohio, from which it appears that his proportion has decreased and his competitor's has increased as follows:

	1893.	1892.
L. & N.	37.3	47.4
C. N. O. & T. P. }	22.1	16.9
Louisville So.	552,172	623,972

The following are also presented:

Iron, etc., from Birmingham district:	
L. & N.	45.4
Ala. G. Southern.	47.1
K. C. M. & B.	7.5
Total tons.	203,281
	350,682

From New Orleans, all freight:

L. & N.	58.0	79.1
N. O. & N. E.	38.6	18.6
Total tons.	41,013	49,654

Of the shipments of grain via Louisville, the Louisville

Southern took 29,693 tons, while the L. & N. got only 1,035 tons.

The letter states that the recklessness of the Cincinnati, New Orleans & Texas Pacific has become so flagrant that doctored expense bills, fictitious changes in the routing of grain and similar practices have become general. To show that the large proportions carried by his competitor must have been secured by unfair means he tells how his own facilities in the way of freight houses, tracks, etc., are much better than the other road's at Cincinnati, Louisville and elsewhere. He also reminds the members of the Association that rate cutting from the Atlantic Seaboard westward, in Southern territory, is common, and that the cotton traffic is in a deplorable condition throughout the South.

He says that some of his competitors may think, if they do not say, that he ought to meet lying, cheating and stealing by indulging in the same practices himself; but he will not do so, and yet he must reduce rates to protect the shippers on his lines, who otherwise would lose business, and his employees, who will be thrown out of work if he has no freight to carry. Mr. Smith refers to the unsatisfactory condition of things when a railroad is operated by a Receiver, the courts holding that they cannot descend to particulars in operating a railroad; that they must trust to the judgment of the best receiver they can find.

Mr. S. M. Felton, Receiver of the Cincinnati, New Orleans & Texas Pacific, sent to the Chairman of the Association a long reply to the statements made in Mr. Smith's letter. He says that Mr. Smith had not told him or any of his traffic men (as he now tells the Association) that he believed the Cincinnati, New Orleans & Texas Pacific was cutting rates. Mr. Felton says that the Louisville & Nashville was interrupted for three weeks in the fall of 1893 by the great storm on the Gulf Coast, seriously diminishing its traffic. The Cincinnati, New Orleans & Texas Pacific suffered from loss of traffic in 1893, as did most other roads. In 1892 it could not handle all the traffic offered, because it lacked cars and other facilities. Since then it has acquired 1,600 new cars. This line is 110 miles shorter, from the Ohio River to Chattanooga, than the Louisville & Nashville, and it has lately put on a fast freight train, which explains why it has secured an increased share of the competitive freight. Mr. Felton objects to the figures given by Mr. Smith and quotes from the statistics of the Association the following percentages of *all* traffic from the Ohio River gateways (for the same half-years which Mr. Smith presented):

	1893.	1892.
Louisville & Nashville	33.59	41.13
C., N. O. & T. P. and Louisv. Southern	19.02	15.78

Although the Louisville & Nashville has better freight-houses in Cincinnati, Mr. Felton makes up for his lack by paying high rentals for facilities in the freight-houses of other roads. At Louisville he pays cartage on freight shipped by houses which have track connection with the Louisville & Nashville. This absorption of drayage is done under an arrangement to which the Louisville & Nashville has agreed. Mr. Smith's statement from Birmingham is objected to, and the following statement, of the percentages by all roads, is given:

	1893.	1892.
L. & N.	34.62	43.88
A. G. S.	26.02	27.81
Others	29.39	28.31
Total tons	265,881	401,614

It is pointed out that the Louisville & Nashville could not compete for shipments of pig iron to New York and New England because the Association rules hindered it from making equitable divisions with connections, and the iron went via Bristol. An iron mill controlled by the Louisville & Nashville was closed in 1893, while one controlled by the other road was running. In 1892 the New Orleans & Northeastern had no soliciting agent in Texas, while in 1893 it had two, getting a share of the grain shipments. The large increase of provision shipments over the Louisville Southern is characterized by Mr. Felton as legitimate. Moreover, the city of Cincinnati favored its own road, the Cincinnati Southern, and Louisville shippers favored the Louisville Southern because they owned bonds of the railroad and wanted to have interest paid upon them.

Finally Mr. Felton says that the statistics at best are somewhat incomplete and inaccurate; that Mr. Smith's statements about doctored expense bills, etc., are without foundation; that although the C., N. O. & T. P. has permitted milling in transit the Louisville & Nashville began the practice; that the latter road has always been domineering, and that it has itself cut rates, the manipulations by it in 1892 having been flagrant. The accusation of illegal discrimination is emphatically denied, and the fact is pointed out that the average rate per ton per mile received by the Cincinnati, New Orleans & Texas Pacific in 1893 was higher than in 1892, which tends to disprove charges of rate cutting.

We have already mentioned the fact that the Metropolitan District (underground) Railway, of London, is equipping some of its carriages with electric reading lamps. The lamps have been put in a good many compartments of the various classes. There is a compact little box containing an incandescent lamp, the light from which passes through a lens like that of the ordinary dark lantern, and is directed downward so as to fall on the book or paper which one may wish to read. Current is supplied

by storage batteries placed under the seats. One may put a penny in a slot and cause the lamp to be lighted, and light will be shown for half an hour. There is a switch to cut off the current in case one wishes to do so after having turned it on. The lamps are also arranged to disgorge one's penny in case they are out of order. This is a convenient and satisfactory arrangement, but naturally one feels as if having paid his fare he ought to have his light free; but if he cannot, two cents must be, for many folks, a small sum to pay for a bright and convenient light for a half-hour's journey, and we recommend this idea to the Manhattan Elevated of New York, which so far declines to give its passengers adequate light. From personal observation we should say that the London experiment is not likely to pay directly, for the use of the lamps seems to be rather limited. Perhaps Englishmen think more of their pennies than Americans, or perhaps they will stand out longer for a principle.

A correspondent inquires if it is right for the brakeman of a passenger train to fill one seat in the rear car with his lanterns, flags, torpedoes and fuses, and such other traps as he may happen to have—say a hat, overcoat and train box. Of course it is not right (and we are reminded, by the way, that Boyd's patent case for holding flags, torpedoes and fuses is furnished with brackets to fasten to the side of the car in a neat fashion); and brakemen who are fully alive to their duty of doing everything they can to make each passenger's journey pleasant are careful not to clutter a seat in such a way. But just how to stop the petty nuisance is not easy to decide. If a superintendent could discharge all the dull brakemen and keep all the bright-minded ones, he could very soon make and enforce a simple rule. Superintendents are annoyed in this matter, perhaps, as often as any one, for when they travel on a local train quite likely they wish to ride at the rear window; but any rule is hard to enforce when the rear car is only half full. The chief need for good discipline in this matter arises from the fact that there are almost always passengers on a train who like to sit at the end window if they can, but who often are too modest to ask the brakeman to move his luggage, thinking he has a right to the seat. Of course the road desires to accommodate such passengers (or we should not see observation cars advertised on the best trains), and so the only proper rule is for the brakeman to leave all seats clear.

The annual report of the "Chaplain" of the Denver & Rio Grande Railroad is published in a recent number of the *Daily Chieftain*, of Pueblo, Col. This road is the only one that we know of which has the distinction of being accredited with a chaplain, and indeed in this case the distinction is, we believe, undesired. The reading-room of the road at Pueblo is in charge of a clergyman, the Rev. John Brunton, but his duties are apparently the same as those of the secretaries of other railroad reading-rooms, and the appellation "chaplain" seems to have originated with the newspapers. The annual report contains the usual statistics of visits to employees, sick and otherwise, and is of a more decidedly religious tone than most reports of the kind. Mr. Brunton has performed three marriage ceremonies and one baptism, which would seem to indicate that Colorado is not so rabid as some states in demanding that railroads shall not perform any functions not specifically mentioned in their charters.

Some of the New Railroad Work in London.

For the last 40 years the railroads of Great Britain have increased in miles of line but about 275 miles a year, and lately the increase has fallen below 200 miles a year, yet construction never ceases, and the investment grows at a tremendous rate considering the mileage. Thus, in 1882 the paid-up capital (shares and loans of all classes) was £68 million pounds sterling, and in 1892 it was £44 million, an increase of 176 million pounds, or in round numbers \$89 million dollars, or say 23 per cent. The increase per mile of road in the same time was from £41,005 to £46,463, or nearly 12 per cent. In the same period the total debt of the railroads of the United States grew from \$7,017 million dollars to \$10,871 million, or 55 per cent., and the debt per mile grew from \$61,500 to \$63,300, or three per cent. The contrast in the rates of growth is remarkable, and it suggests the constant heavy expenditure in England on railroads already built. Some examples of this may now be seen about London, where, during the present year some important railroad extensions are likely to be completed.

Among these the first place must be given to the very large piece of work which during the last four years has been in progress at Liverpool street station, the terminus of the Great Eastern road, a work which, it is claimed, will make the station the largest railroad terminus in the world. The old station, of which the present work is an extension, was constructed about 20 years ago in order that the company, instead of stopping as before outside the City boundary at Bishopsgate, might bring its passengers into the very heart of

London, a few minutes' walk only from the Bank of England, the Royal Exchange and other important centres. As a result of this move the passenger traffic, and particularly the suburban traffic of the road, has increased enormously, so that for some years Liverpool street station has been too small for its proper handling and development.

Accordingly the company acquired an area of land, about 4½ acres in extent, immediately adjoining their existing depot, and early in 1891 set about converting this ground, which was quite covered with small houses, streets and courts, into tracks and platforms for the accommodation of passenger freight. The preliminary work for the preparation of the site for this purpose included the removal of hundreds of small houses, the excavation of about 130,000 cubic yards of earth to bring the new site to the level of the existing station; the erection of a very strong retaining wall to bear the immense lateral strain of the important street thoroughfare which now forms the east boundary of the depot, and the construction of three new bridges to carry cross streets which run from this thoroughfare over the newly cleared area. In the case of one of these bridges an old structure consisting of two brick arches was removed, and a new double girder iron bridge with a span of 80 ft. substituted. This had to be done without interfering with the rail traffic underneath, or stopping the street communication for more than a week. The other two bridges are also double-girder iron structures, having a roadway of over 30 ft. and spans of 105 ft. and 168 ft. respectively.

The area thus cleared has been filled with eight new tracks, running in pairs, between five long parallel platforms, three of which are island platforms; one of these, 700 ft. and the others 500 ft. in length. They are immediately adjacent to and parallel with those of the existing station, which will now contain no less than 20 long parallel platforms, and will measure 500 ft. from side to side. It is covered by a roof of eight spans, four of which are new, viz., two outside spans of 52 ft. each and two central ones of 42 ft. The two widest spans of the old station are 110 ft. The whole depot, with its approaches and buildings, covers 15½ acres of ground. The new platforms will be entered from a circulating area 90 ft. by 210 ft., with lavatories underground, backed by a handsome-looking hall, erected on the higher level and having direct communication with the street both by footway and cab road. Fronting this street, and extending a distance of 500 ft. along the retaining wall above mentioned, a handsome block of five-story buildings has been erected, having an elevation of 90 ft. The ground floor and basements of this block are to be let out as shops, while the upper floors will be utilized as offices by the railroad company.

From this street also entrance is gained to the new parcels offices which form an important feature of the station extension. The site of these offices is most admirably suited for the purpose for which they are intended, for they have been erected on a support of massive iron girders and stanchions over the farther ends of the new platforms, with which they will communicate by six specially constructed hydraulic lifts. The offices, which extend a distance of 188 ft., are flanked by two roadways, supported like themselves on iron girders and stanchions. These will, of course, be utilized for the ingress and egress of the parcels vans, which will thus have a most convenient channel of approach quite out of the way of the general traffic. The parcels office itself is a four-story fireproof building, having a sorting platform on the ground floor 60 ft. wide. It is expected that the new station will be ready for use by July next. Up to the end of 1893 this work had cost over one million pounds, three-quarters of which was for land.

Another important railroad extension in London, part of which is completed and being utilized for traffic and another part in active progress, is the new underground goods station which the Great Northern company for the past three years has been constructing at Farringdon street. This also is an extension of an existing depot, but here the new work is so great as to quite overshadow the old. The preparatory work included the excavation of an open plot of ground 209 ft. long by 208 ft. wide to an average depth of 28 ft. from street level, and the undermining also of the roadways bounding this plot on north and south, to support which bridges consisting of steel girders and stanchions had to be erected in place of the solid earth removed. The larger of these bridges is 150 ft. by 60 ft. and the other 60 ft. by 40 ft. Underneath the northern bridge rails have been laid down communicating with the old underground depot which lies on the other side of the roadway, and on these the trucks will be brought through to the excavated area above mentioned, in which five platforms have been erected, the longest of which is 186 ft. long by 22 ft. wide. These platforms are fitted with hydraulic cranes for loading and unloading goods, and shunting arrangements are facilitated by turntables worked by hydraulic capstans. The object of the erection of the bridge under the roadway forming the southern boundary of this area was to open up communications with the extensive basements of the corporation fruit, vegetable, produce and fish markets, which stand on the other side of this road. These basements were constructed at the time these new markets were erected some years ago, but have up to the present been useless

owing to the lack of adequate approaches. Now, however, they have been leased to the Great Northern company, and form an important part of their new subterranean goods station, which altogether covers 3½ acres underground. It is reached by two broad, sloping roadways, both communicating with important street thoroughfares.

Thus far the work has been completed and is already in use, but operations are now in progress for the construction over the excavated area above mentioned, of an upper floor supported like the bridges on steel girders and stanchions, and which is to be laid out like the underground area with docks and platforms for the reception and handling of freight, and with carting space for the accommodation of vans. These will enter the upper floor on street level by way of two ample gateways, above and around which a handsome block of offices in two stories are being erected for the accommodation of the goods staff. This upper station will be in direct communication with the lower one by means of two specially constructed hydraulic hoists which will work in connection with a traverser which will run east and west between the 14 bays disposed on either side of it. Thus, the trucks arriving on the rails below will be brought up to the higher level by the hoists and thence run off on the traverser into the particular bays where they are wanted for loading and unloading. Another hoist is being constructed to carry consignments of fruit and vegetables arriving at the underground station direct into the corporation market before mentioned. These hoists, together with the traverser, cranes and capstans, are all to be worked by hydraulic power supplied at a pressure of 700 lbs. to the square inch from three pairs of pumping engines, the boilers of which are capable of evaporating 9,000 lbs. of water an hour. It may be added that both the Farringdon street goods depot and the Liverpool street passenger station above described will shortly be lighted by electricity, for both the Great Northern and Great Eastern companies have recently erected large electric lighting stations, from which power will be supplied to illuminate all their principal London passenger and goods depots and their hotels.

Railroad Matters in Chicago.

Freight Traffic.—The improvement in the mercantile and industrial situation was more pronounced the past week than at any preceding time. Nearly all leading branches of commerce and industry showed proof of returning energy, and the results were apparent in the enlarged volume of business handled by the Western railroads. The outward shipments of merchandise, machinery and other freight materially increased, and the heads of the leading jobbing and manufacturing concerns, as a rule, favor the prediction that their shipments to the interior the present and succeeding two months will equal and possibly exceed those for the corresponding time last year. The present condition of freight traffic is also very materially improved by the liberal movement of grain to market, the past week's deliveries here by the Western roads being largely in excess of expectations, and aggregated 4,284,000 bushels against 2,375,000 bushels the corresponding week last year, and 2,972,000 bushels the same time in 1892.

The miscellaneous produce and live stock traffic shows a marked excess above estimates, and a considerable increase was noted in the flour traffic over the week immediately preceding. A conservative official of one of the big lines said: "There are improved prospects in all directions. For example, the blowing in of a number of large blast furnaces situated at interior points on the upper lake peninsula is giving the railroads connecting the furnaces with the iron mines a liberal traffic as carriers of ore from the mines to the furnaces, and distributors of the pig iron. The chief beneficiary in this class of business is the Chicago & Northwestern. The ore freight of the road will soon be materially enlarged by the resumption of work at a number of large mines which depend chiefly or entirely on the Northwestern for an outlet to the lakes. The majority of these mines were closed wholly or in part when the panic was at its height last year, and the loss of business thus occasioned figured materially in reducing the earnings of the road during the closing half of 1893 and the opening month of the current year. A number of large manufacturing establishments along the line in Wisconsin which have for months been idle have either resumed work or will do so at an early day, and the road will necessarily derive material benefits from the increased traffic which the industries will furnish." The St. Paul officials are also predicting a material increase in the traffic of that portion of their system which traverses the sections last mentioned, and particularly from lumber. It is proper to state, however, that the improved business from the sources indicated will be in part offset by a light grain traffic from the spring wheat belt of Minnesota and the Dakotas until another crop of that grain is marketed. The managers of the Chicago, Rock Island & Pacific, Chicago, Burlington & Quincy, and the Southwestern and Southern lines express a fear that the present heavy coarse grain traffic will soon exhaust interior supplies, and that the late spring movement will be below the average of the preceding two years.

The following shows the deliveries of grain (bushels) at Chicago by the leading Western railroads for the

week ending March 10, and for the same time the two preceding years:

	1894.	1893.	1892.
C. & N. W.....	1,251,000	408,000	404,000
Ill. Cent.....	491,000	325,000	467,000
C. R. I. & P.....	468,000	113,000	507,000
C. B. & Q.....	1,023,000	736,000	518,000
C. & Alton.....	47,000	89,000	54,000
C. & E. Ill.....	63,000	5,000	37,000
C. M. & St. P.....	477,000	227,000	584,000
Wabash.....	128,000	51,000	39,000
C. & G. W.....	140,000	180,000	158,000
A. T. & S. Fe.....	185,000	231,000	154,000
L. N. A. & C.....	6,000	.....	.....
Totals.....	4,284,000	2,375,000	2,972,000

The deliveries of flour (barrels) at Chicago by the leading Western railroads for the week ending March 10 and the same time the two preceding years compare as follows:

	1894.	1893.	1892.
C. & N. W.....	15,872	52,596	31,208
Ill. Cent.....	900	1,506	525
C. R. I. & P.....	4,550	11,230	2,125
C. B. & Q.....	5,743	2,918	12,150
C. & Alton.....	2,100	15	2,075
C. & E. Ill.....	450	33,175	.....
C. M. & St. P.....	17,700	1,200	39,839
Wabash.....	450	4,254	125
C. & G. W.....	41,819	600	18,597
A. T. & S. Fe.....	.....	683	150
L. N. A. & C.....	.....	600	.....
Totals.....	89,584	108,906	106,785

The deliveries of grain at Chicago by the Western railroads for the month of February and the corresponding time the three preceding years compare as follows:

	1894.	1893.	1892.	1891.
A. T. & S. Fe.....	819	1,553	474	307
C. & Alton.....	464	872	380	561
C. B. & Q.....	2,743	2,702	2,526	1,320
C. & E. Ill.....	353	532	429	314
C. M. & St. P.....	2,640	1,824	2,771	1,809
C. & N. W.....	3,369	2,273	3,621	1,941
C. R. I. & P.....	1,996	1,192	2,529	1,163
C. & G. W.....	587	895	481	401
Ill. Cent.....	2,236	2,601	2,073	2,142
Wabash.....	717	275	417	419
Wis. Cent.....	36	26	16	63
Other roads.....	758	2,198	2,382	1,638
Total cars.....	16,748	16,943	18,102	12,113

Passenger Traffic.—The improvement in general business is stimulating increased travel. All the leading roads brought to and carried out from Chicago an increased number of passengers the past week. The Atchison, Topeka & Santa Fe officials reported a large increase in the California business, and said the gain more than compensated for the reduction in rates. The Burlington and the Rock Island managers report that their through business west and southwest showed a good increase, and their local travel between interior points was even better than anticipated. They do not claim however, that their aggregate passenger business was equal to the same time last year. The lines having the most direct southern connections reported a fair average travel, although it was stated that the unusually mild weather here had materially curtailed visits to winter resorts in the South. The extreme Northwestern lines very sensibly felt the effect of the general improvement, and the increase in traffic over the St. Paul & Chicago and Northwestern lines traversing Minnesota and the Dakotas was above anticipations. They also reported material gains on their Chicago and Missouri River lines as well as local country traffic. General Manager Earling, of the St. Paul, also stated that the outlook along his system, while not warranting predictions of a rush, was brighter than he had hoped to see the current season, and that the improved condition of most classes of business in the interior seemed to justify expectations of fair earnings the remainder of the spring and early summer.

CHICAGO, March 12.

Congressman Blanchard on River and Harbor Improvements.

The Chairman of the House Committee on Rivers and Harbors has an article in the March number of the *North American Review* which endorses the recent policy of the country in dealing with our watercourses and harbors. Mr. Blanchard also adds to his advocacy of a continuous improvement some valuable information. The Mississippi with its 44 navigable tributaries has an aggregate navigable length of 16,000 miles; other streams flowing into the Gulf of Mexico add 2,870 miles, making a total of 18,860 miles. The streams emptying into the Atlantic have a length of 2,874 miles, and those on the Pacific coast add 2,351 miles; making a grand total without country lakes of 24,185 miles.

The total appropriations for the improvement of these rivers with seacoast and lake harbors and the channels in the lakes, made by government from its commencement to the present time is, in round numbers, \$240,000,000. Up to 1860, the appropriations were \$14,700,000. In the decade ending with 1870 they were \$12,789,182, and for the next decade they increased to \$63,035,656, while for that ending with 1890 they reached an aggregate of \$108,613,066. Since 1890 a little over \$35,000,000 has been appropriated. These expenditures are contrasted with

an expenditure of over \$300,000,000 by Canada on lakes, rivers, canals and railroads. England with only 1,300 miles of coast line, about five per cent. of what we have, expends \$20,000,000 annually upon the same, while \$82,000,000 have been expended on the Mersey and \$20,000,000 upon the Clyde. France with an aggregate length of navigable rivers and canals slightly in excess of the length of natural waterways in the one State of Louisiana, has expended \$650,000,000 since 1814 in canal and river improvements. The total weight of merchandise shipped on the French waterways in 1890 amounted, according to Mr. Delaunay Belleville, in a paper read at the Fifth International Congress on Internal Navigation, to 24,167,343 tons, as against a freightage of 53,424,432 tons for the same year on the great lakes.

The total tonnage entered and cleared at all the ports of the United Kingdom during 1892 was 168,934,300 tons, of which London had 21,769,970 tons, Liverpool, 16,986,532, and Cardiff, 14,496,416 tons. Our domestic movement of freight by rivers, lakes, and canals, with the domestic commerce on the Atlantic and Pacific coasts, aggregated 185,394,665 tons, as shown by the census statistics of Mr. Thos. J. Vivian, which are admittedly incomplete.

Exceptions are taken to the "slow, sporadic, intermittent, uncertain method of providing means to carry on our public works which has operated greatly to our disadvantage" in the past. "The fault of our system lies in not appropriating the amount needed to complete a public work when it is ordered to be commenced, or in not authorizing the making of contracts to complete it." The first reform of these methods appeared in the bill of 1890, when it was provided that the Secretary of War might enter into contracts for the completion of certain projects to be paid for and appropriations may be made. Five works were specified in 1890, and in 1892 thirteen more were placed under contract. In two instances cited, viz.: the 20-ft. channel in the lakes and the improvement of Humboldt Bay in California, contracts have been let for less than half the estimates, which were based on sporadic and uncertain appropriations, and large savings have been made in other instances. In addition, the Chief of Engineers reports that "under the system of continuing contracts it is judged that the works will be completed in one-half the time which would be required were the works to depend on biennial appropriations and a consequent succession of contracts."

Lumber in Car Construction.

BY C. M. HIGGINSON, in the *Northwestern Lumberman*.

It is interesting from a railroad point of view to notice the changes that have been made toward cheapness and simplicity in the use of lumber and other timber products. In the better grades of hard lumber used for inside coach finish and decoration, we notice on every side a movement toward simplicity of pattern and the use of the more expensive woods. Less time is spent, also, in smoothing the surface and rubbing down the varnish coats, and the finish taken by the varnish naturally is left. With ordinary passenger traffic, this style of finish is that which is needed in a first-class coach.

Another item is the use of as low grades of material as are adapted for the desired work, which has the double result of cheapening the work done and of using up more completely the lower grades of lumber, resulting in a more complete utilization of the entire log with incidental revenue to the lumber manufacturer.

There has often in the past been a tendency among woodworking mechanics, partly from pride in the character of their work and partly from the greater ease of working, to use better grades, especially of pine lumber, than the needs of the service really required, and it is of pine mainly that we are now writing. The necessity of greater economies, however, forced a closer examination into ways and means with the result that for many purposes much cheaper grades of lumber were found good enough.

It often happens that in repairing cars or buildings, material can be used which, while not as high a grade as may have been put into the same structures when built new, is fully good enough to use with the partly worn out structure. If, for instance, in repairing a double board car roof after three or four years of use, the same grade of flooring is used that was put on in the first place, we shall have, by the time the balance of the car wears out, a certain amount of high priced lumber, yet good, which has to be thrown away. The operation of this practice has relieved to a certain extent the demand for the higher grades. As it is now, we find that nearly all the products of a pine log are utilized in railroad work. The solid and clearer portion makes bridge, car and building lumber of the better grades. For the middle grades there is an infinity of use, while for the poorer grades, "grub plank" and culls, there is a demand for rough platforms, foundation work, for car door coal gratings and other purposes which were not developed until comparatively recently. The slabs and edgings are used with good results as regards economy for firing engine and stationary boilers as compared with hardwood, and even the sawdust is used in large quantities for icehouses, protecting pipes and tanks against frost, and for deadening car floors.

It would seem as if this increasing variety of use would be to the advantage of the lumber dealers and manufacturers through making a market for the "by" products and low grades of lumber, while still being able to sell them at a comparatively low price for such uses as they are adapted to.

TECHNICAL.

Manufacturing and Business.

The Shiffler Bridge Co., of Pittsburgh, have received the contract for a steel roof to cover the machine shop of the Brooks Locomotive Works, Dunkirk, N. Y.

The Directors of the Michigan-Peninsular Car Co. have voted to postpone the payment of the semi-annual dividend on the preferred stock due in April.

The Brown & Sharpe Mfg. Co., whose works have

been running on short time for several months, have decided to resume 10 hours time, at least for the present.

Mr. I. Burnett, for several years Inspector of the Illinois Steel Co., has taken a position with the Q. & C. Company as Inspector and in charge of application of Servis tie plates.

The Rich Frog Co., of Muskegon, Mich., has been organized with a capital stock of \$50,000 by Edwin Rich, Harrison Rich, W. W. Barcas and F. W. Thompson, all of Muskegon.

The Eastern office of the Drexel Railway Supply Co. is now located at 120 Broadway, New York City. Mr. E. C. Ward has been recently appointed Eastern Agent in charge of this office.

The George Place Machine Co., of New York City, with a capital of \$25,000, has been incorporated in New York, with George Place, Henry M. Livor and W. H. Harrison, of New York City, as directors.

The Richards Lock Nut Co., of San Francisco, has been formed, with George H. Fuller, George C. Richards and C. J. Brusche, of San Francisco; J. T. Hawkins, of Oakland, and R. A. Shade, of Red Bluff, as the directors of the company.

At the recent annual meeting of the stockholders of the Cleveland City Forge & Iron Co., Cleveland, O., the old officers were re-elected, as follows: R. H. Harman, President; L. M. Coe, Vice-President and General Manager; G. F. Fly, Secretary; and R. A. Harman, Assistant Manager.

The Union Switch & Signal Co., which has recently issued its annual report for the year to Dec. 31, 1893, gives the sales during the year as amounting to \$1,227,629. The net earnings were \$260,730. After paying the fixed charges amounting to \$71,820, there remained net profits of \$197,910.

The American Mineral Wool Co., of New York City, has been chartered in New York with a capital of \$21,000. Frederick H. Prentiss, of Chicago, Ill.; Charles H. Rockwell, of Cleveland, O.; Wallace C. Andrews, W. F. Weiss, Bailey Whipple, Henry Franz and W. J. Townsend, New York City, are directors.

The Southwestern Bridge & Iron Co., of Fort Worth, Tex., will soon be prepared to operate its shops. The machinery is now nearly all in place. The tools have been purchased from the Long & Allstatter Co., of Hamilton, Ohio; the Morgan Engineering Co., of Alliance, Ohio; and the Excelsior Machine Works, of Cleveland, Ohio.

John H. Dawson and Edward D. Goodwin, under the name of Dawson & Goodwin, have opened salesrooms at 57 South Canal street, Chicago, for handling machinery. They are agents for the Lodge & Shipley Machine Tool Co., of Cincinnati; Hamilton Machine Tool Co., of Hamilton, Ohio; Springfield Machine Tool Co., of Springfield, Ohio; and Deitz, Schumacher & Co., of Cincinnati.

New Stations and Shops.

The Philadelphia Gas Improvement Co., of Philadelphia, has placed the order for the iron roof over its new coal shed with the Berlin Iron Bridge Co., of East Berlin, Conn., and the New Jersey Zinc & Iron Co., at Newark, N. J., has placed the order for the iron roofs on its new buildings with the same company.

The shops of the Lehigh Valley at South Easton, Pa., are to be enlarged and it is stated that they will be made the main repair shops of the company. It is said that much of the work now done at Sayre will be removed to the South Easton shops and that the foundry work which some months ago was transferred to Weatherly will again be done at South Easton.

A new Union station is to be erected at Jacksonville, Fla., according to the announcement in a local paper. It is said that the site chosen is on the south side of West Bay street, near Fifth street, and that the Florida, Central & Peninsular, the Jacksonville, St. Augustine & Indian River and the Savannah, Florida & Western have agreed to join in the erection of the new station.

The iron work for the extension of the E. W. Bliss Co., foundry building at Brooklyn, N. Y., will be furnished by the Berlin Iron Bridge Co., of East Berlin, Conn. The Calumet & Hecla Mining Co., has placed the order for a new iron building, 40 x 125 ft., with the Berlin Iron Bridge Co. The building will be covered on the roof and sides with the Berlin Iron Bridge Company's anti-condensation corrugated iron.

The contract for erecting the new shops of the Louisville, New Albany & Chicago, at Lafayette, Ind., is to be awarded this week. The town of Lafayette has voted the sum of \$130,000 to the railroad company to secure the building of the shops at Lafayette, Ind. In order to hasten the work on the buildings a number of citizens have agreed to advance \$50,000 of this sum, which, as it will have to be raised by taxation, is not immediately available.

Iron and Steel.

The stockholders of the Columbia Iron and Steel Mills at Uniontown, Pa., are making arrangements to start the plant in the near future. The works have been idle for two years.

The Illinois Steel Works have started three blast furnaces at South Chicago, and will have 2,000 men at work this week. A portion of the Bayview plant, which has been idle for eight months, has been reopened.

The Pueblo Steel Works has given orders to start up

the rail mill and converter at Pueblo, Col., this week, giving employment to 400 additional men and increasing the force to 1,000.

Orders have been booked whereby the Bethlehem Iron Co.'s, steel mill will continue running day and night until the end of the month. The mill has not run more than a fortnight at any time for more than a year. Fifteen hundred hands are employed.

All the departments of the Cambria Iron Works at Johnstown, Pa., which have been idle, resumed business this week. The Johnson Steel Works, at the same place, also started up after an idleness of three months. About 2,000 men went to work for the two corporations.

The stockholders of the Lackawanna Iron and Steel Co. met in Scranton, March 7 and elected the following directors: Moses Taylor Pyne, Samuel Sloan, S. S. Palmer and William E. Dodge, of New York; Walter Scranton, East Orange, N. J.; John I. Blair, Blairstown, N. J., and William Connell, W. W. Scranton and James Blair, of Scranton.

The Toledo Machine & Foundry Co., of Toledo, O., are experiencing a prosperous season. They are just beginning the construction of two steam shovels to be used on the Chicago Main Drainage Canal; these will be larger than any heretofore built by the company. The shops of the company are working full capacity day and night, and have orders which will keep them busy for six months.

The Johnson Steel Co., which proposes to remove part of the plant now located at Johnstown, Pa., to another location, is understood to have decided upon a site near Cleveland, O., for the new works. Vice President T. L. Johnson, of Cleveland, states that a plant costing \$3,000,000 will be erected and will include four blast furnaces, a converting plant, a blooming mill, a standard "T" rail mill, a street railroad rail mill and a shape mill. Mills will also be erected for girder rails for street railways and for structural iron.

Electric Canal Towage.

The work of putting in an installment for towing by electricity on the canal at Bourgogne, France, was completed last August. This is used only, as we understand it, at the terminus where the electric installation is used to haul the boats over a distance of about six kilometers. The power is taken from the water falling from the feeding reservoirs and drives turbines which actuate the dynamos. The latter are two Gramme machines and deliver a current of from 500 to 600 volts. The tow-boats take the current by means of trolleys. The towing is accomplished by a submerged cable.

Mr. F. W. Hawley, Vice-President of the Cataract General Electric Co., is said to have secured from the New York State Department of Public Works a permit for 50 years for his company to put on the state canals some means of towing by electricity. The company proposes to take power from the Niagara Falls Power Co., and transmit it to Albany. The present notion is that the company holding this permit will put on tug boats to be operated by electricity and will tow its own barges or the horse boats which may be offered for towing.

Graphite Paint for Boiler Tubes.

The Detroit Graphite Mfg. Co., of Detroit, Mich., is manufacturing a graphite paint which experiments show will prove valuable in a very extensive field. A year ago several of the flues of a boiler at the company's works were given a coat of the paint. When they were examined a few days ago they were found in as good condition as when painted. The other flues, which had not been coated with the graphite, were badly corroded. The painted flues, on the other hand, had a clean and almost polished surface. In a few weeks we hope to be able to give a report of a similar test made on the tubes of a locomotive boiler. It may be argued that a coating of the paint on the water-side of the tubes would retard the transfer of heat to the water, but if so, it would hardly be to the same extent that a coating of scale from $\frac{1}{16}$ to $\frac{1}{8}$ in. or more thick would do. The tests in the stationary boiler showed that the paint prevented the scale from forming on the tubes, and there is no reason for supposing that the same would not be the case in locomotive boilers.

Another test, to show the effect of the paint on wood, was to expose a piece of board, covered with the paint, to the action of salt water; after several years' exposure the wood is apparently as good as at first. The paint is very adhesive, it adheres to bright tin so that the tin may be bent back and forth till the tin breaks without flaking the paint. This paint promises well for use in various ways by railroads; those parts of refrigerator cars, especially the springs, which are so seriously affected by the brine which drips from the car, will be well protected with a covering of it. Its application in marine service can be readily understood.

Webster Steam and Oil Separators.

The note published in this column in the issue of March 2 reporting the result of the test made in the Webster separators at the World's Fair, gave the name of the gentleman making the test as Mr. Geo. H. Barnes. It should have been Mr. Geo. H. Barrus, of Boston, Mass., who was at the head of the Committee on Tests.

The Harper's Ferry Improvements.

The Baltimore & Ohio Railroad Company opened the new bridge at Harper's Ferry for traffic on March 5. The new bridge will take the place of the bridge which spans

the Potomac River at that point. Its construction began about 18 months ago. In connection with the bridge a tunnel 875 ft. long has been built through Maryland Heights, which serves to avoid a heavy curve around the base of the mountain, and gives a direct entrance to Harper's Ferry across the new bridge. The old bridge structure will continue to be used for highway purposes.

The Battleship Indiana.

The contractors' unofficial trial of the battleship Indiana took place March 7 off the Delaware capes, where she made a record of 15.65 knots per hour. This speed was made under the full air pressure of one inch and with 128 revolutions, the engine cards indicating 8,000 H. P. The horse power to be developed upon the official trial will be 9,000, and with the advantages of hand-picked coal, clean fires, deep water and a straight course it is fair to presume that the speed will be at least 16 knots an hour, and probably 16 $\frac{1}{2}$ knots, in which case the premium will be \$150,000. The trial was in 21 ft. of water, while on the official it will be 24 ft. The Indiana is 348 ft. long on the water line with an extreme breadth of 69 $\frac{1}{2}$ ft., 24 ft. draught forward and aft, 10,288 tons displacement, and 15 knots sustained sea speed.

Basic Steel Production.

The output of steel and ingot iron from phosphoric pig iron for 1893 was 3,638,556 tons, an increase of 13.6 per cent. over the make of 1892. Of the total, 2,808,241 tons were produced by the basic Bessemer process and 830,315 tons in basic open hearths. In addition to the output of steel, 874,000 tons of slag with 36 per cent. of phosphate of lime were produced. Nearly all of this was ground, and used as a fertilizer.

The production for the two years, classified both as to countries and percentage of carbon, was as below:

	1893	With	1892	With
	Total.	under	Total.	under
England	358,036	17 p.c.	406,839	317,583
Germany and Luxemburg	2,314,754	1,971,441	3,013,481	1,616,783
Austria and Hungary	314,992	229,957	288,122	212,408
France	393,017	243,263	287,538	196,190
Belgium, Russia and United States	257,757	163,491	206,667	129,028
Total, tons.....	3,638,556	2,901,597	3,202,650	2,471,992

A new feature in the basic steel trade is mentioned by the *American Manufacturer*, viz., a demand in England for the top cinders produced by puddling furnaces. This is found to supply desirable heat giving qualities, and instead of being sold at 3d. per ton as in the past, for use in blast furnaces, it is now commanding 4s. per ton for steel making. This new demand will not only have a tendency to remove "cinder pig" from the market, but will help the puddlers in their fight against steel.

United States Timber Tests.

We have received from Prof. J. B. Johnson the following note with regard to the present state of legislation on this subject. The first year a little money was given to this work from the regular Forestry Division funds. The second year a special appropriation of \$2,000 was made. The third year (1893) a bill appropriating \$40,000 for the work was introduced, and could have been passed if those interested in it had exerted themselves in time. As it was, an addition of \$12,000 was made to the department bill for this purpose as a direct result of the demand made upon Congressmen by those interested in this work. The special bill has been again introduced in the Senate by Senator Coke, of Texas, and referred to the Committee on Agriculture and Forestry. It is now in the hands of a sub-committee, consisting of Senators Roach and Proctor, who have asked for information upon it, and who desire to know the popular demand for such work. If this amount of money could be appropriated, an additional testing laboratory would probably be established on the Pacific Coast, for the purpose of testing the timbers of that region. Those who desire to exert their influence in favor of a more rapid progress of this work should address either Senator Roach or Senator Proctor, and also their representative in Congress, urging the passage of such a bill.

Harveyizing Steel.

The new Harveyizing plant at the Homestead Works has been completed and a test plate will soon be shipped to the proving grounds at Indian Head.

Petroleum Residue as Fuel for Steamships.

The British steamship "Baku-Standard," a bulk oil carrier, arrived at Philadelphia recently from Shields, England, having burned on the passage liquid fuel only. The trip was an unusually trying one, the vessel having been caught in Arctic drift ice and detained so that the passage required 26 days. The oil (petroleum residue) is sprayed by a steam jet, and the boilers are protected by brick. The consumption was about 20 tons for every 24 hours. The residuum was from Russian oil, but on the outward trip Pennsylvania oil will be used. The number of firemen required was reduced by 12, there being on duty only two boiler tenders and two greasers at a time. The "Baku-Standard" is owned by A. Suet, of London; she registers 3,705 gross tons, and is 330 ft. long, 43 ft. beam and 23 ft. depth of hold. She carries over 1,200,000 gallons of petroleum in bulk, and goes to Russia as well as to the United States for oil.

Large Stationary Engine.

The Massachusetts Cotton Company, of Lowell, has purchased from the William A. Harris Steam Engine Company, of Providence, a 1,500 H. P. engine with a maximum capacity of 2,000 H. P. It is of the twin compound type, and can be operated as a compound condensing or

non-condensing engine, and either side can be run independently of the other as a simple condensing or non-condensing engine. The high-pressure cylinder is made in sections, and is steam jacketed. The exhaust ports are placed in the heads, thereby doing away with the usual large passages for the steam, and reducing the clearance space. The clearance space in this cylinder is less than 3 per cent. The frames are of the well-known girder type. The connecting rods are of steel, and the crank pin end is similar to a solid end rod, except that it is open on the bottom side to allow it to drop over the crank pin box after it has been placed in position on the crank pin. An accurately fitted block is placed in the opening on the bottom of the rod, and a steel bolt is passed through the jaws of the rod and the inserted block, the whole thus being firmly held together.

Ropes are to be used for the transmission of power. The wheel is 30 ft. in diameter, with a face of 85 in. and is turned for 33 $\frac{1}{4}$ -inch wire ropes. The rim is made in 10 segments. There are two sets of arms—20 in all—and two centers or hubs. At 60 revolutions the speed of the circumference of the wheel is over a mile a minute. The speed will be controlled by the Porter governor, so arranged as to control the cut-off of both cylinders with an attachment for varying the cut-off in the low-pressure cylinder. In addition to this there is a "fixed cut-off" for the low-pressure cylinder.

The principal dimensions of the engine are: Diameter of cylinders, 32 and 56 in.; stroke, 72 in.; cross head pins, 7 $\frac{1}{2}$ in. in diameter and 9 in. long; crank pins, 9 in. long and 9 in. in diameter; main bearings, 18 in. in diameter and 32 in. long; piston rods, 5 $\frac{1}{2}$ in. in diameter. The weights of the various parts are: High-pressure cylinder, 22,000 lbs.; low-pressure cylinder, 43,000 lbs.; two frames, 41,000 lbs.; two pillow blocks, 20,000 lbs.; wheel, 140,000 lbs.; shaft with blank centers, 60,000 lbs. The total weight, not including the pistons and other smaller parts, is 326,000 lbs.

THE SCRAP HEAP.

Notes.

A ship which loaded at Wilmington, Del., last week for Brazil, had as part of her cargo five locomotives, 25 first-class passenger cars and 180,000 ft. of lumber.

Michael Burns, who tried to wreck a night express train on the Philadelphia, Wilmington & Baltimore two months ago, has been imprisoned for five years.

A train of the Mobile & Ohio was stopped by robbers on the night of March 6, near Forest Lawn, Ill., who attacked the express car in regulation style; but it appears they secured no money.

The Buffalo, Rochester & Pittsburgh has made a reduction of 10 per cent. in the wages of all employees receiving \$10 a month or more. The Great Northern has adjusted the grievances of its engineers and other employees who objected to a reduction of 10 per cent. in pay.

A number of important grade crossings at streets over the Old Colony Railroad in the city of Brockton, Mass., are to be abolished, the special commissioners appointed by the court to prescribe a plan for bridges having issued a decree last week. It is expected that work will begin very soon.

Straws are blowing, here and there which indicate more or less increased activity in business. The Chicago & Erie has re-employed many of the freight train crews who were discharged early in the winter. The eastbound movement of freight over the Baltimore & Ohio is reported to have decidedly increased.

Judge Baldwin, in the state circuit court at Cleveland, O., has confirmed the decision of the lower courts in the case against the Lake Shore & Michigan Southern brought to make a test of the law requiring railroads to stop at least three trains each way each day except Sundays at towns of over 3,000 inhabitants, if so many trains are run. The test case was made by the state of Ohio on relation of George L. Lawrence and was decided in favor of the state.

In the United States Circuit Court at Charleston, S. C., last Tuesday, Judge Simonton filed a decree in the much litigated railroad tax case. Last year the assessments on all the railroad property were raised by the State Board of Equalization. The railroads refused to pay the taxes on the increased assessment, and carried the case into the United States courts. They tendered the amount of taxes due on the old assessment. The case now decided was brought by D. H. Chamberlain, Receiver of the South Carolina. The Court, in a long opinion, decides that the assessment was not unconstitutional, and orders the Receiver to pay to the state the balance of taxes due and also the costs of action.

Mr. Wilson, of Iowa, has introduced in the United States Senate a bill to kill out ticket scalping. Its provisions are similar to those of the Pennsylvania law, every ticket seller being required to hold a certificate from the company employing him. The Lower House of the Massachusetts Legislature, has passed a bill providing that 10 hours work, to be performed within 11 consecutive hours, shall constitute a day's work on railroads. A bill has also been presented to compel the railroads of that state to issue interchangeable mileage tickets. Its framers have aimed to avoid the faults of the law of 1892 on this subject, which was declared unconstitutional. The special committee of the House Judiciary Committee, at Washington, has been granted \$500 for expenses in investigating the action of Judge Jenkins and others in issuing injunctions forbidding railroad employees to strike. An investigation has been held in Lincoln, Neb., as to the soundness of the maximum freight rate law, known as the Newberry bill, which was passed in that state a year ago, but which the State Board of Transportation was enjoined against enforcing. It appears that the bill was not read three times,

as required by the Constitution, and that changes were made in it before it was signed, without proper authority.

South American Notes.

The railroads centering at Buenos Ayres, in response to a petition from the Argentine Rural Society, have reduced the freight on cattle intended for the markets in that city.

The Director of Public Works in Chili has been authorized to repair and improve the Andine Road from Junear to the Cumbre, for which purpose \$37,462 have been appropriated. This will facilitate transit between the two ends of the Transandine Railroad.

The Statistical Annual of Uruguay shows that the total value of real estate held by natives in that country is \$134,179,443, against a value of \$137,139,088 held by foreigners. The order in regard to values represented by the several nationalities is, Italian, Spanish, Brazilian, French, Argentine, British, German and Portuguese. North Americans are lowest on the list, holding property valued at \$288,206.

The World's Fair Awards.

It seems probable that the official awards for the World's Fair will not be given out before next year, but every exhibitor is entitled to receive a *pro forma* official copy of his future diploma. The delay seems rather long, but probably the results are worth waiting for.

Law Lectures to Students in Engineering.

The University of Cincinnati has arranged for a course of lectures on legal questions, of importance to engineers, to be delivered before the students in civil engineering at that University. The following gives the programme of the lectures: "The Law of Contracts," A. B. Benedict, B. A., LL. D., March 8, 15 and 22; "The Law of Contracts," M. B. May, A. M., March 29 and April 5; "The Law of Real Property," D. S. Oliver, B. S., LL. B., April 12, 19 and 26; "The Law of Eminent Domain," J. G. O'Connell, B. L., LL. B., May 3 and 10; "Laws Pertaining to Navigable Streams and Riparian Rights," J. G. O'Connell, B. L., LL. B., May 17; "State and Federal Governments," M. B. May, A. M., May 24.

The Sensible Views of an Iowa Newspaper.

According to the fifth statistical report of the Interstate Commerce Commission, the amount of railroad stock paying no dividends in 1892 was \$2,807,403,328, or 60.6 per cent. of the total amount of railroad stock issued. In addition to this, \$777,719,420, or 15.56 per cent. of the whole amount of funded debt, did not pay interest. It is learned from Poor's Manual that the average dividend on railroad stock for 1892 was 1.68 per cent. Assuming for the sake of argument that 50 per cent. of the stock represents water (which it does not), the dividends would only amount to twice 1.68, or 3.36—say 3 $\frac{1}{2}$ per cent. The dividends and interest on railroad stocks, bonds and debt for 1892 averaged 3.01 per cent. There is hardly any business in which there is hazard that does not pay from 5 to 7 per cent. and upward on its capital. The gross passenger earnings for 1892 were \$293,557,476; freight, \$816,716,759. Assuming the population of the United States to be 65,000,000, this would show that the passenger fare paid per head of population per annum was \$4.51; freight, \$12.56; total, \$17.07. Poor's Manual shows that for 1892 the percentage of operating expenses to earnings was 70.4 per cent. of the gross revenue, which shows that more than two-thirds of the \$17.07 per head of population, or \$11.38, has been indirectly returned to every individual, leaving \$5.69 per head of population as the developing force which has advanced the price of farmers' lands along the lines from the original cost of \$1.25 per acre to \$40 and \$50; provided for labor the wage fund; opened up territory to the products of the artisan; giving the tradesman his living and the lawyer his luxuries. . . . State legislation has stepped in and assumed the right to arbitrarily fix the railroad's schedule of charges. It has lowered rates—in infinitesimal in beneficial results when subdivided among the whole community, but of vital consequence in the aggregate to the railroads. . . . We do not believe that the right of legislative control extends to an arbitrary fixing of tariffs. . . . Legislation should protect both the people and the railways from discriminations as between individuals or communities; the laws of trade should do the rest. Is it not time to rescind all adverse legislation, and to recognize that injustice cannot be practiced against the railroads simply because they necessarily represent capital in an aggregate form, without slowly jeopardizing the interests of every citizen? If a storekeeper makes five cents on the dollar on an annual turnover of \$50,000 his profit of \$2,500 enables him to live, to put in a new store front, to get a new delivery wagon, and to pay off on his property; but if he makes but one cent on the dollar on his annual turn-over, the \$500 profit barely provides him with a living, and no matter how hard he works he cannot get ahead in lifetime. It is the same with the railroads: no matter how great the tonnage, if there be not a fair margin of profit the extension and improvement of the railroads and the further development of the country are a long way off.—*Ottumwa (Iowa) Daily Courier*.

Lectures on Engineering at the University of Wisconsin.

A series of lectures on engineering topics has been arranged by the officers of the University of Wisconsin to be delivered during the early months of the present year before the students of that institution at Madison, Wis. The initial lecture in the course was on Jan. 12, when Mr. Gilbert Wilkes, late Chief Engineer of the Detroit Electric Works, lectured on Dynamo Designing. Among the other lecturers in the course have been Mr. Robert W. Hunt, of Chicago, who spoke on the Manufacture of Steel; Mr. J. F. Wallace, Chief Engineer of the Illinois Central, whose topic was Recent Improvements on the Illinois Central Railroad at Chicago; Mr. C. T. Purdy, of Chicago, on Iron and Steel Tall Building Construction, and Mr. L. F. Loree, Division Superintendent of the Pennsylvania Co., of Cleveland, O., whose topic was Track. The other lecturers and the subjects so far as arranged are as follows: March 23, C. M. Conradson, M. E. Madison, Wis., Superintendent, Gisholt Tool Works, A Modern Machine Shop; April 13, L. A. Ferguson, Chicago, Electrical Engineer Chicago Edison Co., Modern Electric Light Stations; A. T. Rogers, Milwaukee, Professor Milwaukee High Schools; April 27, Electrolysis; May 4, Geo. E. Waldo, Chicago, The Obtaining of Patents; May 11, Elisha Gray, Highland Park, Ill., The Telautograph; Mr. Kempsmith, Milwaukee, Superintendent of Tool Shops, The Milling Machine; May 18, Aug. Lindemann, Milwaukee, Presses and the Die and Tool Work Connected Therewith; Jas. W. See, Hamilton, O., Patents and Mechanisms; T. F. Johnston, Chicago, Principal Assistant Engineer Chicago Drainage Canal, Sanitary Features of the Drainage Canal.

Hydraulic Prison Cells.

Patentable novelty and the adaptation of well known physical phenomena to special purposes is not often better illustrated than in the hydraulic prison cells, patented by Mr. P. Emerson Glafke, and recently tested at Cheyenne, Wyo. The walls of the cells are made wholly of iron or steel pipes, which are filled with water under pressure. Any leak in the pipes will show at once a reduction of the pressure therein, and be indicated by an electric alarm in the warden's office. The locks in the doors are also operated by hydraulic pressure. It will be impossible for a prisoner to saw off a bolt or bar of these cells without causing a leak and sounding the alarm, as all the parts are made hollow and filled with water under pressure. Certain sections of the country infested by train robbers are much in need of such a prison, and it would be a blessing to have an occasional pipe burst if the supply of water were unlimited and the cells watertight. Before the system is perfected somebody will have to invent a device by which the Court can have knowledge of the operations of the sheriff and his deputies.

Colonel Jeffords Works the Press.

Current returns go to show that American railroad companies are making considerable efforts to economize, whether genuine economy or not remains to be seen. An account is published of a tubular iron-frame car of about 30 tons carrying capacity, and the total of repairs comes only to 11s. per wagon against £5 16s. for a wooden wagon, and about £4 for a wagon in this country. It may be that there is money in this idea, and it is wanted here as well as elsewhere.—*Herapath's*.

The Kinetoscope.

This is one of Edison's latest productions. It consists of an instrument for taking a great number of photographs in a short time, thus obtaining a continuous photograph of the entire motion of the object or person. The photographs follow each other in such rapid succession that the series of pictures becomes in effect one picture.

The camera consists of a large, square box, about 4 ft. by 3 ft. It is provided with a revolving slide. Back of the spring is a sensitive gelatine plate in the form of a band that runs on two rollers. The rollers are revolved rapidly by electricity. Forty-six pictures are taken in one second, and the exposure lasts 20 seconds—the length of time required to unroll the band.

Blast Furnace Capacity on March 1.

The weekly capacity of the furnaces in blast on the first of this month was, according to the *American Manufacturer*, 115,039 tons. This is an improvement of nearly 6 $\frac{1}{2}$ per cent. as compared with the production on the first of February, and about 48.8 per cent. as compared with the capacity in blast on Oct. 1 of last year. The subjoined table shows the capacity of furnaces in blast on the first of each month since Jan. 1, 1891.

	1891.	1892.	1893.	1894.
January	163,281	191,442	175,701	102,999
February	139,559	193,067	173,385	108,321
March	120,745	193,827	177,210	115,069
April	113,316	188,109	182,169	.....
May	116,586	175,343	186,982	.....
June	147,729	172,890	177,407	.....
July	167,424	169,850	160,952	.....
August	174,502	158,581	115,926	.....
September	174,506	156,191	83,481	.....
October	181,818	161,558	77,334	.....
November	192,743	173,925	84,635	.....
December	193,009	175,111	98,089	.....
Total production	8,279,870	9,157,000	7,124,502	.....

From this it will be seen that our production now is about equal to that of Aug. 1, 1893. The recovery from the depression of last year is unexpectedly slow. With No. 1 anthracite quoted at \$13@\$13.50, and Bessemer pig at \$10.50@\$10.75, with bridge steel varying from 1.40 for angles to 1.60 for sheared bridge plates, it seems as if the demand ought to exceed a rate of 6,000,000 tons per annum, which is about the rate of our present production.

The Chicago Main Drainage Canal as She Is Known in England.

Our contemporary *Transport* has some mail advices, "with regard to the ship canal which is to connect Lake Michigan at Chicago with the head of the Illinois River, southwest of that city," in which this additional information is given: "Ten miles of its length will be in the shape of a tunnel under the dividing ridge between the Mississippi Valley and Lake Michigan, and it is an interesting question whether or not a tunnel of this kind can be successfully used for a ship canal." The site of this tunnel must have been submerged last Friday when the Drainage Trustees made their now famous high-water exploration, as no notice of it appears in the record of the trip. The correspondent has a modified, but possibly correct, view of the relations which will obtain between the channel and the sewage of Chicago. He says: "It is said that a volume of water from the lake equal to 800,000 cu. ft. per minute will be sent through the canal, and that this will be ample to keep the rivers through which it has to pass free from contamination by Chicago sewage, which it is admitted will drain into the canal to some extent [We should say so], and which Mississippi Valley people are becoming alarmed about. When the canal is constructed navigation between the Great Lakes and the Gulf of Mexico will be complete." This makes us wonder if we possess as curious and complicated a fund of misinformation about affairs in England.

A Failure of Cast Iron Columns.

Major-General Hutchinson's report to the Board of Trade has been issued, giving the result of his inquiry into the circumstances connected with the accident which occurred on the 12th of December at Portsmouth Harbor Station, when the roof covering the arrival island-platform was blown down by a high gust of wind just as a train was leaving. Several persons were injured, one seriously. The fall of the roof must, Major-General Hutchinson says, in the absence of any other probable cause, be attributed to the effect of a sudden gust of wind during the prevalence of a gale. The zinc roof covering did not give way, but the wind pressure was transmitted toward the base of the cast iron columns—a double row of which supported the roof—with the result that one (or more) of these was at once broken off 4 ft. above its base (which was bolted down to wrought iron cross girders, connecting the cast iron columns employed in the structure of the station), this being immediately followed by the similar fracture of the whole of the 40 remaining columns, and the fall of the roof. The columns were all broken in two places, the two points of fracture being in each column almost identical. The thickness of metal was intended to have been uniformly $\frac{1}{2}$ in., and it must have been

either from a deficiency in this thickness or from a flaw in the casting that the force of the wind was able to break a column thus weakened. The evidence of the witnesses does not lead to the impression that they had felt the force of the wind very excessive when the roof fell. Theoretically, these columns should have been able to sustain a far greater pressure than they were ever likely to have been exposed to.—*Colliery Guardian*.

An African Railroad.

A proposal has been brought forward to promote the building of a line of railroad connecting the Lower Shire highlands with Lake Nyassa, at a cost of about £500,000, and a committee has been formed to collect all the necessary information and to bring the matter before financiers in England.

The English Association of American Bond and Shareholders.

At the annual meeting the Chairman (Mr. Joseph Price) said that they were constantly applied to for additional allotments of their stock, but it was unnecessary for them to increase their capital, and they could only invest it in bonds producing five per cent., whereas they would have to pay a dividend of $\frac{1}{2}$ per cent. on the money. They had an insurance of £50,000 against any possible loss on receiving stock the signature on which might be a forgery, or against their receiving stock to which the person bringing it to them might not have a valid title. If necessary they could pay back in 24 hours every penny that the shareholders had subscribed, and he thought this was very satisfactory, looking at the condition of American affairs. The real reason for establishing the association had been to get over the difficulty which existed in the passing of American railway shares in blank transfers. It was absolutely necessary that this plan should be the existing one in England, as the American transfer agencies were all in New York, and it would be impossible to do American business if people had to wait until the stock was sent to New York to be registered. The Dutch people did a very large business in American railway shares, and they entirely adopted the system of certificates—that was to say, they deposited the original American share, and issued the certificate of the Administration of American Railways against it. . . . He hardly cared to refer to the disabilities which existed in connection with the registration of American railway shares in the names of nominal holders, but two cases had lately come before him which he might mention. In one of these cases one house was registered for 70,000 shares, and in the other case the house was registered for 63,000 shares, whereas neither house owned one of these shares. . . . As they were aware, the last two or three years had been a very trying period for all who were connected with American railways, and the total collapse which had occurred since July 1 last none of them had ever witnessed before. An important point in connection with the working of American railways was economy, and he thought their system of large freight cars was far superior to the English system of small trucks. On the other hand the English system of carrying passengers was more economical than the American, the dead weight in the former case being about one ton, and the latter four tons per passenger.

Kirkman's Multiplex System of Accounts.

The multiplex system of railroad accounts, devised and patented by Mr. M. M. Kirkman, Second Vice-President of the Chicago & Northwestern, and well known as a writer on railroad accounts, is to be "pushed." The American Accounting Company, composed largely of railroad accounting officers, having bought from Mr. Kirkman all his rights. The President of this company is Mr. C. G. Phillips, of Chicago, well known as the Secretary of the American Association of Railway Accounting Officers. The essential idea of the multiplex system is the use of thin paper blanks and carbon sheets, so that a freight clerk can fill out two, three or more entries, pertaining to the same shipment or transaction, at one writing. By preparing blanks with suitable printed headings, the expense bill to be delivered to the consignee, the receipt to be signed by the consignee's drayman and the record to be kept by the station agent may be filled out at one writing, thus saving labor and insuring accuracy. The advertisements of the new proprietors of the system state that the Chicago & Northwestern saves \$10,000 a year by the use of these blanks.

Smokeless Powders.

Industries and Iron gives what may interest our readers to learn, the composition of the new smokeless explosive, the Leonard powder, which has been tested with great success in the United States, and which has provoked the recent suits to test the Cordite patent in England.

The ingredients of the Leonard powder, according to the patent specification, for the United States 30-caliber rifle are given as follows:

150 parts by weight of nitro-glycerine,	
50 " " gun cotton,	
10 " " lycopodium,	
4 " " finely-triturated urea crystals,	

the proportions are varied according to the caliber of the gun which is to use it.

If dinitrobenzol be employed in the manufacture instead of finely-triturated urea crystals a similar quantity, namely, four parts, should be used. The several ingredients named above are first mixed together, and there is then introduced as a solvent either acetone alone or acetone combined with acetate of anhyd or acetone combined with acetic ether. The solvent is evaporated by agitation and the material is formed into a cake or granules by pressing in molds. The analysis of Cordite, which we give for the sake of comparison, is as follows:

Gun cotton, as previously used at Waltham Abbey	37 parts.
Nitro-glycerine	58 "
Vaseline	5 "

Total 100

The solvent here used is again acetone, the proportion being 19.2 parts. The mixture is incorporated for three and a half hours, and is then squeezed into threads. If the "scouring" and "pitting" actions which accompany the use of Cordite are obviated in the "Leonard" powder a bright future is before it.

LOCOMOTIVE BUILDING.

The Valley Road of Ohio has ordered two ten-wheel locomotives from the Pittsburgh Locomotive Works.

The Schenectady Locomotive Works have just completed for the New York Central & Hudson River road a locomotive numbered 888, similar to the famous 999, and another will soon be built.

CAR BUILDING.

The Cleveland, Lorain & Wheeling is in the market for 1,000 cars.

The Delaware & Hudson has specifications ready for a number of new freight cars.

The Jackson & Sharp Co., of Wilmington, Del., has an order for 40 milk cars from a Philadelphia dairy company, to be run on the Lehigh Valley road.

The South Jersey Railroad Co. has awarded a contract to Harlan & Hollingsworth, of Wilmington, Del., for the construction of 25 passenger coaches to be completed by May 15.

BRIDGE BUILDING.

Allentown, Pa.—Viewers have been appointed on an iron bridge to connect Allentown and South Allentown, via Fifth street.

Buffalo, N. Y.—A bill has been introduced in the New York Legislature to authorize the building of a new bridge over the Erie Canal at Porter avenue and providing for the removal of the present bridge at that street to another location. The improvements are estimated to cost about \$20,000, and the Park Commissioners of Buffalo, and the State Government will bear equal shares of the cost.

A number of property owners have presented a petition to the Common Council asking that body to authorize the erection of the bridge across Buffalo Creek at the foot of Commercial street. George E. Mann, Ex-City Engineer, has made the surveys.

Chambersburg, Pa.—The county will build a bridge with a span of about 20 ft. over Falling Spring at Kennedy street.

Columbia, Tex.—The County Commissioners have appropriated \$20,500 for a bridge over the Brazos River at this point, and it is expected that the International & Great Northern will pay the balance of the estimated cost of the bridge, which will be \$25,000 altogether.

Columbus, O.—Indications point to the early construction of bridges in Franklin County as follows: Columbus & Sunbury turnpike bridge (bonds for which are now offered for sale to the amount of \$25,000); Coe Road bridge (bonds offered \$15,000); Clifton avenue bridge (bonds offered, \$20,000). The above figures indicate the maximum sum which the bridges shall cost, as fixed by the County Commissioners. Proposals for the erection of the bridges will not be asked until after the bond sale on April 27 has taken place.

Dorchester County, Md.—The bill recently introduced in the Maryland Legislature to authorize the County Commissioners of Caroline and Dorchester counties to build a free bridge over Linchester street has been signed by the Governor and has become a law.

Governor Brown, of Maryland, has approved the bill authorizing the construction of a bridge over the Nanticoke River, between Wicomico and Dorchester counties.

Downie, Ont.—Mr. P. Smith, Clerk of Township of Downie, will receive tenders until March 23 for building a steel bridge, known as Byer's Bridge, in the Township of Downie, the bridge to be 78 ft. long, with a 14-ft. roadway, situated about five miles from Stratford Station.

Hamburg, Pa.—The Berks County Commissioners have been petitioned to erect a new bridge across the Schuylkill River at a point two miles south of Hamburg. The bridge would be about 150 ft. wide, and it is estimated that it could be built for \$12,000.

Hastings, Minn.—The project to construct a wagon bridge across the Mississippi River at this point is being agitated.

Helena, Mont.—The County Commissioners of Lewis, Clarke and Teton have awarded the contract for the construction of an iron wagon bridge over the North Fork of Sun River. The Wrought Iron Bridge Co., of Canton, O., was the successful bidder at \$7,700.

Jefferson City, Mo.—Senator Cockrell, of Missouri, has introduced a bill in the United States Senate for building a bridge across the Missouri River at Jefferson City by the Jefferson City Bridge & Transit Co.

Kalispell, Mont.—The County Commissioner of Flathead County last week awarded the contract for the construction of a steel bridge across the Kalispell River at this place to the Gillette-Herzog Manufacturing Co. of Minneapolis.

Lansing, Mich.—The Mayor of Lansing has recommended the building of a bridge at Michigan Avenue, in a special message to the City Council, the bridge to the full width of the street. He favors the erection of a concrete-iron bridge on the plans and specifications of the Melan Arch Construction Co., of New York, and the City Engineer is also in favor of this plan. The bridge will be 230 ft. long and 115½ ft. wide.

Montreal, Que.—The City Engineer has reported that the bridge over the Canadian Pacific tracks on Notre Dame street in connection with the new East End station will cost \$112,000.

Oakville, Ont.—A swing bridge will be built over the harbor on Coborne street, in this town. Plans are at the office of County Engineer McDougall, Court House, Toronto, Ont.

Philadelphia.—The residents of the thirty-seventh and thirty-eighth wards of Philadelphia are anxious to secure a new bridge across the Schuylkill River at Gray's ferry, and recently have held a number of meetings and asked the Common Council to pass an ordinance which has been pending in that body for some weeks providing for such a bridge. The structure now spanning the river at this point is of wood, and was built over 30 years ago. It is owned by the Pennsylvania Railroad, but it is believed that if the city agrees to pay a portion of the cost of a new structure that the Pennsylvania and a street railroad line will agree to pay part of the cost of the erection of a new bridge.

Rochester, N. Y.—A bill has been introduced in the legislature to authorize the state engineer to prepare plans and estimates for complete repairs to the lift bridge over the Erie Canal at West Main Street. If, in the opinion of the engineer, the cost of the repairs will approximate the cost of a new bridge he is to prepare plans for a new bridge. The sum of \$3,000 has been appropriated.

Engineer J. M. Floesh, of the Buffalo, Rochester & Pittsburgh, is preparing plans for a number of bridges which will be built this summer on the southern end of the Buffalo, Rochester & Pittsburgh.

The City Engineer has prepared plans for a six arch

bridge at Mortimer street, having a total length of 224 ft.

Scranton, Pa.—Councils have adopted a resolution directing the City Engineer to prepare plans and specifications for the Linden street and Roaring Brook bridges. Upon the completion of the plans the City Clerk is to advertise for proposals to build the bridges. An ordinance has also been passed appropriating \$35,000 for the securing of suitable approaches for the Pittston avenue bridge.

Toledo, O.—The city has accepted the offer of the Lake Shore & Michigan Southern to build a bridge over its tracks and on Junction avenue. The structure is to be of either iron or steel with an 18-ft. roadway and foot walks on each side.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Albany, quarterly, \$2 per share, payable March 31.

Chicago, Milwaukee & St. Paul, semi-annual, \$2 per share on the common stock and \$3.50 on the preferred stock, payable April 19.

Cleveland, Cincinnati, Chicago & St. Louis, quarterly, $\frac{1}{4}$ per cent. on the preferred stock, payable April 2.

Manhattan Elevated, quarterly, $\frac{1}{2}$ per cent., payable April 2.

Sunbury & Lewistown, semi-annual, 4 per cent., payable April 2.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atlantic & Northwest, special, Montreal, Quebec, March 27. To authorize the issue of bonds for the construction of the road, and to approve of the lease to the Canadian Pacific.

Canadian Pacific, annual, Montreal, Quebec, April 4.

Chicago & Alton, annual, Chicago, Ill., April 2.

Chicago & Grand Trunk, annual, Chicago, April 11.

Grand River Valley, Jackson, Mich., April 25.

Joliet & Chicago, annual, Chicago, Ill., April 2.

Malone & St. Lawrence, annual, New York City, March 22.

Mohawk & Adirondack, annual, New York City, March 22.

New York Central & Hudson River, annual, Albany, N. Y., April 18.

New York & Rockaway Beach, annual, New York City, March 27.

Oregon, Short Line & Utah Northern, annual, Salt Lake City, Utah, March 21.

Panama, annual, New York City, April 2.

Pennsylvania, annual, for election of directors, Philadelphia, Pa., March 27.

Pittsburgh, Cincinnati, Chicago & St. Louis, annual, Pittsburgh, Pa., April 10.

Texas & Pacific, annual, New York City, March 21.

Toledo, Ann Arbor & North Michigan, annual, Toledo, O., April 18.

Western Terminal Co., special, Pittsburgh, Pa., Mar. 20.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The Master Car Builders Association will hold its annual convention at Saratoga, N. Y., beginning June 12. The hotel headquarters will be at Congress Hall, H. S. Clements, Manager.

The Master Mechanics' Association will hold its annual convention at Saratoga, N. Y., beginning June 18.

The National Association of Local Freight Agents will hold its annual convention at Pittsburgh, Pa., June 12, 13, 14. The headquarters will be at the Monongahela House.

The American Association of General Passenger and Ticket Agents will hold its next annual meeting at the Hotel Royal Poinciana, Lake Worth, Fla., March 20.

The New England Railroad Club meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The Central Railway Club meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, April, September and October. The next meeting will be on Wednesday, March 28.

The Southern and Southwestern Railway Club meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November. The next meeting will be on Thursday, April 19, at 10 a. m.

The American Society of Civil Engineers meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month at 8 p. m.

The Canadian Society of Civil Engineers meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday at 8 p. m.

The New York Railroad Club meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The Northwest Railroad Club meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month at 8 p. m.

The Western Railway Club meets in the rooms of the Central Traffic Association, Monadnock Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The Technical Society of the Pacific Coast meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The Association of Engineers of Virginia holds informal meetings the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m. The next meeting will be held on Wednesday, March 21. The subject will be Blast Furnace Construction.

The Boston Society of Civil Engineers meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The Western Society of Engineers meets on the first Wednesday in each month, at 8 p. m. The headquarters of the society are at 51 Lakeside Building, Chicago.

The Engineers' Club of St. Louis meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas Place, St. Louis, on the first and third Wednesdays in each month.

The Engineers' Club of Philadelphia meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The Engineers' Society of Western Pennsylvania meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7:30 p. m.

The Civil Engineers' Club of Cleveland meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The Engineers' Club of Cincinnati meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 7:30 p. m.

The Engineers' Club of Kansas City meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The Engineering Association of the South meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The Denver Society of Civil Engineers meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The Montana Society of Civil Engineers meets at Helena, Mont., on the third Saturday in each month, at 7:30 p. m.

The Engineers' Club of Minneapolis meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The Northwestern Track and Bridge Association meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m.

The Engineers' and Architects' Club of Louisville meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday in each month.

The Civil Engineers' Society of St. Paul meets on the first Monday of each month.

The Scandinavian Engineering Society of Chicago meets in room 300, Title and Trust Building, 100 Washington street, on the third Thursday in each month.

New York Railroad Club.

Three subjects were announced for discussion at the meeting of the club on March 15, each topic being introduced by a short paper. The titles of the papers were as follows: 1. "What Is An Economical Load for the Locomotive, from the Standpoint of the Motive Power and Transportation Departments," by George W. West, Supt. M. P. N. Y., O. & W. R. R.

2. "Car Construction and Its Relation to the Motive Power and Transportation Departments," by James Donnelly, Supt. L. V. R. R.

3. "From What Class of Employees Should the Locomotive Firemen Be Selected?" by W. G. Wattson, Supt. West Shore R. R.

Central Railway Club.

The next regular meeting of this club will be held at the Hotel Iroquois, Buffalo, N. Y., Wednesday, March 28, at 10 a. m. The paper on "Air Brakes: Their Inspection and Maintenance," presented at the January meeting, will be discussed. Members are requested to present all possible information on this subject, and it is hoped the matter of air brake plants may be well illustrated by drawings, etc. No special subject bearing on motive power matters has been announced, but members are urged to come prepared with queries on points with which they have had trouble or unusual experience, and if possible to acquaint the President with same by letter before the day of meeting.

A vote will be taken to amend an article of the constitution to read as follows: "That officers shall be elected at the annual meeting for a term of one year, and without nomination, but by written ballot in open meeting; that the presiding officer shall not succeed himself in office, and the incumbent shall alternate each year between a master car builder and a master mechanic."

The officers of the club extended an invitation to officers in the operating departments of railroads as well as all others interested in the best development of good railroading to attend the meetings.

Engineers' Club of St. Louis.

The club met at 1600 Lucas place, St. Louis, on March 7, with President Crosby in the chair and 40 members and 2 visitors present. An application for membership was announced from Edward B. Fay, Civil Engineer, with George S. Morison, Chicago. A committee of five was appointed by the chair to devise means to raise funds, to consider questions relative to the improvement of the library, and to report back to the club, the librarian to be a member of the committee. The chair appointed on this committee J. A. Laird, Philip N. Moore, T. L. Condon, J. B. Johnson and E. A. Herrmann.

M. L. Holman, Water Commissioner of the city of St. Louis, then addressed the club upon the general features of the "New Water Works," discussed it briefly in its historical, present and future aspects. The first agitation for water works in St. Louis began in 1829, and the first works were built in 1833-36, with pumping station at the foot of Ashley street, and a wooden reservoir 100 ft. sq. at Collins and Ashley streets. The pipes were all of lead, put in by the city. The works were later moved to the foot of Bates street, with a reservoir at Twenty-second and North Market. Mr. Kirkwood, of Brooklyn, was appointed to make investigations for a new system, and as a result the present system at Bissell's Point was constructed, going into service in 1872. There are now 420 miles of pipe in this city, the amount having doubled in the last 15 years. The general features of the new works at the Chain of Rocks and at Baden were described. The question of the best handling of sediment in the Bissell's Point reservoirs was discussed. The reservoirs being now operated at beyond double their rated capacity, it was found necessary to operate them by continuous flow, which rendered it impossible to secure any great amount of settlement. After discussion by Messrs. Moore, Flad, Seddon, Ferguson and Crosby, the meeting adjourned.

Engineers' Club of Cincinnati.

At the last regular meeting of the club Mr. M. D. Burke read a very interesting and valuable paper on "A Ship Canal from Cincinnati to Toledo," in which he reviewed the question of the construction of a canal of sufficient dimensions for transporting boats and barges of large size between the Great Lakes and the Ohio River. He reviewed the work that has been done in past years in making surveys and examinations, and to the plans for enlarging the present Miami and Erie Canal, with a view to adapting it to that purpose. He discussed the question under the three heads:

1st. What are the requirements necessary for a navigable waterway connecting the Lakes with the Ohio River. 2d. Are the physical conditions such as to make such a line practicable in this locality, or is some other line a better one? 3d. Are the benefits to be derived such as to justify the required expenditure? Under the

first head he discussed the more prominent canals of the United States and the changes that have been made in their dimensions from time to time since their original construction to make them of sufficient capacity to meet the increasing demands of traffic. He argued that if it is thought advisable to enlarge the Miami and Erie Canal it should be at once given the maximum dimensions that the water supply will admit of and be properly equipped.

Under the second he described in a comprehensive way the geological structure of the country that the canal would traverse and gave elevations at various points on and adjacent to the line and an idea of the possible source and extent of the available water supply and suggested that an exhaustive examination and survey might develop that the summit level could both be lowered and shortened, thus lessening the quantity of water required.

Under the third he exhaustively treated the question of exchange of commodities. The soft pines and hemlock lumber, grain, salt, copper, etc., would be shipped from the north in exchange for yellow pine and the hard lumbers, corn, cotton, tobacco, marble, iron, coal, early fruits and vegetables, etc., from the South. The author believed that Cincinnati and the Ohio valley with its central position for distribution, an almost unlimited supply of fuel, of limestone for flux, of iron ore, with direct water transportation from the Superior mines, would become the great manufacturing center of the iron and steel industry of the United States. The development of the great Northwest also demands a better water transportation route for an outlet to the seaboard, by which we shall become the central manufacturing and distributing metropolis in the inland line of water transportation from New York to the Gulf. If these results are to be achieved action should not be delayed. It will require years of labor and millions of money to accomplish, and investigation should be at once commenced.

At the meeting of the Club on March 15, Mr. Charles Wood, Chief Engineer of the Cincinnati, Hamilton & Dayton Railroad, gave some account of the construction of the new freight house erected by that company at Cincinnati.

Association Engineers of Virginia.

A monthly meeting for informal discussion was held Feb. 28, with President Mr. C. S. Churchill in the chair. Mr. C. C. Wentworth spoke on highway bridges, and gave an interesting description of a method for tabulating work in preparing the estimate and economizing in time and money in placing the working drawings in the shops. Complete tables were exhibited, giving weights of trusses of various forms for given lengths and panel loads, of floor beams for given widths, panel lengths and floor loads, and of bracing for given spans and widths, by means of which an accurate estimate of the iron work in a given structure could be obtained; also strain-sheets blanks, giving for the various forms of trusses the strain on each member by simple multiplication by the assumed dead and live load per panel, and tables of sections from which the approximate section for each chord, post or tie can be chosen when the strain is determined. Standard shop drawings were also exhibited, showing eye bars, chord members and posts of different sizes in which only a few blank dimensions have to be filled in to adopt them to any given length. The subject was discussed by Messrs. Henderson, Yeatman and others.

Mr. Coleman for the "State Road Law Committee," reported that although the proposed road law did not pass the legislature, it had been well considered, and would probably be brought up again.

The subject announced for the next informal meeting to be held by March 21 is "Blast Furnace Construction," the discussion to be opened by Mr. Rubens P. Patterson.

Engineers' Society of Western Pennsylvania.

The regular monthly meeting of the Engineers' Society of Western Pennsylvania, which occurred on Feb. 20, was largely attended. The newly elected President, Charles Davis, occupied the chair. Several persons were elected to membership, and changes proposed in the by-laws, making the meeting night for the society after March the third Thursday instead of the third Tuesday. The night for the meeting of the Chemical Section was changed from the fourth Tuesday to the fourth Thursday. After the business meeting Mr. Charles F. Scott presented a very interesting and well-prepared paper entitled, "Electrical Systems of Distribution." It was illustrated by large diagrams, and by interesting experiments, and evoked considerable discussion.

The Chemical Section met on Feb. 26, W. E. Koch in the chair and 20 members present. Mr. R. N. Clark read a paper about the Chemistry of Gold Milling, giving especial attention to roasting sulphurates and the extraction of gold by chlorine, bromine and cyanide solutions, also in regard to the interference of acid and alkaline waters in all usual methods. His remarks were concluded by reference to the chlorinating system used at the Weadwill mill in Alaska, and the adoption of the Malloy process for cyanide now being used in Colorado.

Boston Society of Civil Engineers.

A special meeting of the society was held at its rooms Feb. 6. The meeting was called to continue the discussion begun at the last meeting, "On the Organization and Methods of Carrying on the Work of a City Engineer's Office." Mr. Dexter Brackett, of the City Engineer's office of Boston, opened the discussion with a short paper on the records of a water-works department. The paper was discussed by Messrs. F. L. Fuller, A. F. Noyes and E. W. Shedd. The next paper was by Mr. G. A. Nelson, who gave an account of the survey of the city of Lowell, Mass., and was followed by Mr. E. W. Shedd with a description of the survey now being made for the city of New Bedford, Mass. The subject of indexing and arranging plans was then taken up, and the method in use in the City Engineer's Office of Providence was explained in a communication from O. F. Clapp. The discussion on this topic was continued by Messrs. G. A. Kimball, E. P. Adams and E. A. W. Hammatt. Mr. J. F. Desmond, City Engineer of Haverhill, Mass., read a paper on the work of the office in that city, and Mr. Henry Manley closed the discussion with a short paper on bridge inspection.

The regular monthly meeting of the society was held on Feb. 21, Vice-President Noyes in the chair. Mr. Luther H. Bateman, of Boston, was elected a member of the society. The by-laws of the society were amended increasing the dues of resident members from \$6 to \$7. A short memoir of Charles W. Drake, a member of the society, was read by Mr. H. B. Wood.

Mr. Thomas F. Richardson, who was Chief Engineer of the Pike's Peak Railroad during its construction, then read a very interesting paper describing the build-

ing of that road. A large number of drawings were shown giving the details of the locomotives, cars, rack-rail, etc. At the conclusion of the paper a series of lantern views were shown covering the entire length of the line. During the remainder of the meeting Mr. Desmond Fitzgerald exhibited some lantern views of arctic explorations and some very beautiful colored views of Japan.

At the meeting on March 21 Mr. W. E. Foss will read a paper "On Formulas for Flow of Water in Pipes and Channels." Mr. W. B. Fuller will read a paper on "Street Grades." Mr. George Bowers, City Engineer, of Lowell, will give a statement of the experience of that city in obtaining a water supply from driven wells.

Master Car Builders' Association.

The Committee on Brake Beams has issued a circular of inquiry embodying the following questions:

Are you using the Christie brake head with iron brake beams on freight cars? Please state name by which the beam is known and name of manufacturer. State distance from center to center of brake heads and the size of brake hanger eye. State size of lever pinhole in strut. Have you adopted the Master Car Builders' standard of 40 deg. angle of brake lever from the vertical? If not, what number of degrees from the vertical have you adopted? Do you hang the beam described inside and between the wheels or outside of the wheels? How many cars have you equipped with this beam hung outside, and how many with it hung inside? Is your present standard outside or inside hung? What is the total number of freight cars in your equipment?

A diagram is printed on the circular, and the dimensions are requested for outside and for inside hung beams. Any other information than that covered by questions which are thought proper for the committee to consider, in connection with the subject of a standard height for beams measured from the rail to the center of shoe, and a standard location for the brake lever pin-hole and brake hanger eye as measured from the center of the shoe horizontally to the center of the two holes, is solicited.

Replies should be sent to E. D. Nelson, Pennsylvania R. R., Williamsport, Pa.

American Society of Civil Engineers.

At the meeting to be held on Wednesday evening, March 21, a paper by Morton L. Byers, Jun. Am. Soc. C. E., on the "Removal of the Channel Pier of the C. & M. V. Railroad, over the Scioto River," will be presented. The following is an abstract:

Among the structures damaged by the floods in the spring of 1893 was the east pier of the single-track bridge of the Cincinnati & Muskingum Valley Railway, across the Scioto River, near Columbus, O. When the writer took charge, false work had been driven to relieve the pier, plans prepared, bids requested, and the estimate of the probable cost was \$3,500.

The plan provided for a masonry pier rising on three lines of piles driven at about 4 ft., longitudinally, between centers, capped transversely with a grillage of two courses of 12×12 in. hard wood timber, drift bolted to the caps. From base of rail to low-water mark was 28 ft. 9 in., and the top of the grillage was 10 ft. 3 in. additional, or 13 ft. 3 in. to the top of the piling. As a protection against undermining, a ring of piling had been previously driven at about 25 ft. from the pier, entirely around it, and the space inside filled with riprap and blast furnace slag.

The last flood had undermined the nose of the pier to some extent, and on the subsidence of the flood the pier cracked from top to bottom and began to settle badly, requiring temporary bents to be placed to carry the two spans resting on the pier.

A single bid of \$8,500 was received for the work. An investigation at this time showed that the two spans were carried by temporary bents on either side. The space between the pier and the old piling had been filled as described.

At a depth of 18 ft. below low-water a bed of hard blue clay was found, while in the vicinity of the pier, and carrying it, was a mound of about 80 ft. in diameter of sand and gravel, extending to the surface of the water, the clay being exposed beyond the base of the mound.

As the temporary bents were but about 13 ft. apart, the boat, 40 ft. long and 14 ft. wide, which had been built for use in driving the piling, could not pass between them, and it was evident that some sort of a coffer-dam was a necessity. This, to enclose all the temporary bents, needed to be about 65 ft. square, and would require piles about 28 ft. long. It was also probable that a heavy expense for pumping would be incurred. Under the most favorable circumstances, about eight weeks would be required to build this dam, and the excavation would require about three weeks more. This would bring it to the last of October before the pier could be out of danger from high water, and low water could not be counted on after the middle of September.

An estimate of the probable cost amounted to something over \$8,000.

To do the work economically required that the coffer-dam be dispensed with, by sawing the piling off to a level under water, or by possibly dispensing entirely with piles if the bottom be found suitable. The difficulty presented was to make the excavation, and the riprap could not be removed until the pier itself was removed. A dredge small enough to work between the bents was not to be had, and the job was not large enough to pay the expense of purchasing the special tools required. It was finally resolved to use a scraper, made at the railroad shops, of old boiler iron strengthened by three ribs of light iron rail and operated by a 20-H. P. two-drum hoisting engine mounted on an island formed just above the pier. The towing line was run direct from one drum to the back of the scraper, and the back line from the other drum ran over a sheave on the bridge to the front of the scraper, thus giving entire control of its movements. It was necessary to remove 13 of the old piles, forming the upper end of the ring. This was done by sawing off to a level the piles at either side, and using two 20-ton hydraulic jacks resting on these, with a 12×12-in. timber between, chained to the pile to be drawn.

The dredging was completed over the entire foundation to a depth of 12 ft. on Sept. 1. To prevent the scraper from upsetting when it came in contact with a piece of riprap, a piece of rail was bolted across the teeth.

After a depth of 12 ft. had been excavated throughout, it was decided to dispense with the piling, and a crib of six courses of 12×12 in. timber, arranged so as to form three lines of pockets, each 4 ft. × 2 ft. 6 in., open at top and bottom, was built in place. The middle pockets were provided with slat bottoms, and filled with cobble stones. Two-inch tongued and grooved siding was nailed to the top course of the crib, and braced so as to form a coffer-dam, and the crib

was sunk by placing rails on the top of the dam thus made.

To level the bottom for the final resting place of the crib, a rail 11 ft. long was dragged back and forth over it. The reason for putting no bottoms in the outer pockets of the crib was that at some points the earth was soft underneath the crib and had been excavated deeper than at other points, and it was desirable that those should be filled up. After sinking, a slight ridge of gravel and sand was thrown up entirely around the crib, and then each outside pocket had placed in it about $\frac{1}{2}$ cu. yd. of rich mortar and an equal amount of concrete, all of which was thoroughly rammed. This was done to force the mortar under the edges of the crib and into the gravel, where it had been loosened. The center pockets were then treated with a rich grout, and the outside pockets with cobble stones and grout. The 18 pockets contained 1,008 cu. ft. in all, and the writer estimates that there were 525 cu. ft. of voids in the pockets and 189 cu. ft. in the gravel underneath, which were filled by the grout.

Removing old pier.....	\$189.13
Excavation, including the cost of scraper and wire rope.....	311.06
Foundation, including cost of timber, framing, concreting, pumping and cement.....	750.09
Masonry at \$7.50 per cubic yard.....	1,955.32

Total..... \$3,235.60

The lowest bid received after the change of plan was \$6,655.10.

A paper by A. C. Cunningham, Assoc. M. Am. Soc. C. E., on "An Instructive Eye-Bar Test," will also be presented.

Civil Engineers' Society of St. Paul.

The regular meeting of the Civil Engineers' Society of St. Paul, was held at St. Paul on March 5, 16 members and 3 visitors present.

Mr. C. J. A. Morris, informally addressed the meeting on the subject of Coal Docks and Coal Handling Plants. He illustrated his theme by maps, plans, photographs, &c., of the belt railroad and coal dock of the Northwestern Railway Co., now building at Superior and of various elevating, conveying and coal handling devices. The belt line is projected to intersect all railroad lines entering Duluth and Superior, of which there are at present six. The dock will be formed by filling to an average depth of 10 ft. a tract of more than 75 acres, to be bounded by cribs of 12-in. x 12-in. timber hemmed in by a row of 60-ft. piles driven to 4-ft. centers. The cribs are 22 ft. deep, 24 ft. wide and are sunk in 250 ft. sections with material (principally sand), raised by a hydraulic dredge, capable of moving at least 300 cubic yards of solid matter an hour. The dredge consists of two scows of $5\frac{1}{2}$ ft. draft connected by a hinge joint. The end of the 20-in. suction pipe, carrying a revolving cutter, which masticates anything in its way except solid rock, ranges vertically 28 ft. and horizontally 80 ft. by the swinging of the smaller scow, the main boat (95 ft. long), being anchored by fore and aft spuds. If the dredge is swung from the forward spud a range of 150 ft. is secured. A 400-horse power engine works the pump (centrifugal), and cutter. Material may be economically carried through the 18-in. delivery pipe 3,500 ft. The plan of handling the coal on the ample dock has not been definitely fixed.

PERSONAL.

—Dr. William Taussig has been re-elected President of the Terminal Railroad Association of St. Louis.

—Mr. W. P. Burbank, for many years Roadmaster of the Concord & Montreal, died in Concord, N. H., March 6, aged 60 years.

—Mr. R. L. Cobb, Chief Engineer of the Ohio Southern, has been appointed Chief Engineer of the Cleveland, Akron & Columbus, to succeed James Harrington, resigned.

—Mr. James C. Hallsted, C. E., member of the firm of G. W. G. Ferris & Co., has removed from Chicago, and is now in charge of the firm's business in the East with headquarters in Philadelphia, Pa.

—Mr. W. K. Blodgett, President of the Passumpsic Valley Railroad, died at his home in Boston, Mass., on March 4, aged 67 years. He was at one time President of the Ogdensburg & Lake Champlain.

—Mr. W. T. Reed, Superintendent of Motive Power of the Chicago Great Western, has resigned. Mr. Reed has been at the head of the mechanical department of this road for several years and prior to accepting service with it was Superintendent of Motive Power of the St. Paul, Minneapolis & Manitoba. Mr. Reed has also been in charge of mechanical departments of the Grand Trunk and Canadian Pacific.

—Mr. William O. Hughart, President of the Grand Rapids & Indiana road, has tendered his resignation of that office on account of ill health. He will continue a director and was re-elected to that office at the annual meeting just held. His resignation as president will take effect in April. Mr. Hughart has been President of this railroad for 20 years. Until 1892 he also acted as General Manager of the company, when he was succeeded by Mr. J. H. B. Hughart, the present incumbent.

—Mr. William Stevenson, formerly Superintendent of the Northern Division of the Lehigh Valley Railroad, died of consumption at Jacksonville, Fla., on March 11. He was born at Gouverneur, N. Y., studied surveying and civil engineering, and then entered the employ of the State Line & Sullivan Railroad. When the Lehigh Valley took possession of the Easton & Amboy Railroad, Mr. Stevenson became Superintendent of the latter road. After several promotions he was appointed Superintendent of the Northern Division of the Lehigh Valley Railroad, and directed the construction of the Buffalo Extension. His health becoming impaired, he resigned his position soon after the Lehigh Valley was leased to the Philadelphia & Reading.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—The position of General Car Inspector for the trans-Ohio divisions, held by W. F. Bently, of Zanesville, O., has been abolished. Mr. Bently becomes General Foreman of the B. & O. shops at Zanesville.

Boston & Maine.—John W. Sanborn, who has been Acting General Manager of this railroad since the death of Mr. J. T. Furber, in 1892, has again assumed the superintendence of the Northern Division, with headquarters at Wolfboro Junction, N. H., the position which he held before his removal to Boston.

Brooklyn Elevated.—W. E. Hedding has been appointed clerk to I. D. Barton, General Superintendent. Mr. Hedding was, until a year ago, Assistant to O. F. Nichols, Chief Engineer.

Butte, Anaconda & Pacific.—J. J. McLaughlin, former Superintendent of the St. Paul division of the Chicago Great Western, has been appointed Superintendent vice G. F. Cooper, resigned. His office will be at Butte, Mont.

Cannan & Black Forest.—The first directors of this Pennsylvania company are: Robert McCullough, Jersey Shore, Pa., President; Joseph Wood and Joseph S. Childs, Jersey Shore, Pa.; Daniel Shepp, Tamaqua, Pa.; William Boyer, Lock Haven, Pa.; Walter C. Wood and Harry S. Childs, Ulceter, Pa.

Caroline Central.—J. T. Elmore, formerly Roadmaster of the Eastern Division, has been appointed Roadmaster of the Western Division with headquarters at Charlotte, N. C. A. A. Chapman has been appointed Roadmaster of the Eastern Division with headquarters at Maxton, N. C.

Chicago, Milwaukee & St. Paul.—The headquarters of H. R. Lloyd, General Fuel Agent, will be removed on May 1 from Milwaukee to the Old Colony Building, Chicago, where the chief offices of the company will be located.

Choctaw Coal & Railway Co.—B. F. Dunn has been appointed District Freight and Passenger Agent of the Western Division, with headquarters at Oklahoma City, Okla.

Clearfield & Conemaugh.—The incorporators of this company are: Hon. S. J. M. McConnell, Harrisburg, Pa., President; and J. M. Cooper, G. P. Prentice, C. H. Sockridge, of Pittsburgh; T. D. Singiser, Johnson City, Tenn.; B. F. Meyers and David Fleming, of Harrisburg.

Cleveland, Akron & Columbus.—The vacancy caused by the resignation of Chief Engineer James Harrington is to be filled by the appointment of Chief Engineer R. L. Cobb, of the Ohio Southern, to be Chief Engineer of both roads.

Connecticut & Passumpsic Rivers.—A meeting of the directors was held in Boston, Mass., March 7, and Amos Barnes was elected President to succeed W. K. Blodgett, deceased.

Elmira, Cortland & Northern.—The following directors were elected at the annual meeting held in New York City, March 13: Ausin Corbin J. Rogers Maxwell, Henry W. Maxwell, J. D. Campbell, A. N. Hebre, W. J. Hebre, J. K. O. Sherwood, George S. Edgell, Charles M. Reynolds, Frederick Cook, E. R. Reynolds, W. G. Bosworth and W. J. Kelly.

Evansville & Richmond.—H. P. Radley, formerly Agent and Superintendent of Terminals in Evansville, Ind., has been appointed General Passenger and Freight Agent, Auditor and Treasurer, with headquarters at Evansville, Ind.

Gulf, Colorado & Santa Fe.—The annual meeting was held in Galveston, Tex., March 6, and the following directors were elected: J. W. Reinhart and J. J. Cook, of New York, B. Adne, George Sealey, Leon Blum, J. H. Hutchins, J. W. Terry and T. W. Jackson, of Galveston. The following officers were elected: President, J. W. Reinhart; Vice-President, D. E. Robinson; Second Vice-President, G. Sealey; Secretary and Treasurer, J. M. Bird; Auditor, W. E. Lufkin.

Indiana & Illinois Southern.—M. D. Crawley has been appointed General Passenger Agent of this company with headquarters at Sullivan, Ind.

Missouri, Kansas & Texas.—The office of Superintendent of Bridges and Buildings has been abolished, and the duties of the office will be performed by Cary A. Wilson, Chief Engineer, of Parsons, Kan.

Missouri Pacific.—The annual meeting was held in St. Louis, Mo., March 13, and the following directors were elected: George J. Gould, Russell Sage, Edwin Gould, Louis Fitzgerald, John P. Mann, John G. Moore, Howard Gould, Samuel Sloan, Thomas T. Eckert, and D. P. Parmy, of New York City, and S. H. H. Clark, C. G. Warner, and D. K. Ferguson, of St. Louis. C. G. Warner and D. K. Ferguson were elected to succeed A. L. Hopkins and C. S. Greely.

Pennsylvania.—R. A. Park, Passenger Agent for the southwestern district, at Washington, D. C., has been succeeded by Colin Studds, formerly District Passenger Agent at Atlantic City, N. J., which office has been abolished.

Peoria, Decatur & Evansville.—A. G. Palmer has been appointed General Passenger and Freight Agent, the appointment to take effect April 1. Mr. Palmer was formerly General Passenger Agent of the Evansville & Terre Haute.

Seaboard Air Line.—W. L. O'Dwyer has been appointed Division Freight and Passenger Agent, with headquarters at Atlanta, Ga.

St. Louis, Chicago & St. Paul.—The office of Superintendent of Car Service has been abolished and H. L. Harford, formerly cashier, has been appointed Car Accountant. B. L. Babb, formerly Superintendent of Car Service, has been appointed Car Service Agent.

St. Louis, Iron Mountain & Southern.—The annual meeting was held in St. Louis, Mo., March 13 and the following directors were elected: George J. Gould, Russell Sage, Samuel Shether, John T. Terry, D. D. Parmy, of New York City; Henry Whelen, of Philadelphia; A. L. Hopkins, of Boston, and R. J. Lackland, S. H. Clark, C. G. Warner, and D. K. Ferguson, of St. Louis.

Terminal Railroad Association of St. Louis.—The annual meeting was held in St. Louis, Mo., March 7, and the following directors were elected: William Taussig, W. B. Doddridge, C. G. Warner, E. P. Bryan, M. E. Ingalls, W. W. Peabody and Charles M. Hays.

Texas Midland.—William Irwin, of Pennsylvania, has been appointed Division Superintendent, with headquarters at Terrell, Tex., to succeed H. A. Couse, deceased.

West Jersey.—At the annual meeting held in Philadelphia March 6 the following directors were elected: George B. Roberts, Coleman F. Leaming, John M. Moore, George Wood, N. Parker Shortridge, Henry D. Welsh, W. J. Sewell, Benjamin F. Lee, James H. Nixon, Josiah Wistar, David B. Gill, William G. Nixon, Samuel Rea, William Bettie, Charles E. Pugh.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Athens & South Waverly.—A company has been formed in Athens, N. Y., to build a railroad connecting Waverly, Sayre and Athens, to be known under the above name. The officers are: President, Charles Kellogg; Vice-President, A. C. Robertson; Treasurer, N. C. Harris; Secretary, G. H. Stenson; Directors, Charles Kellogg, A. C. Robertson, N. C. Harrison, Thomas Buchanan, L. Sanford, M. P. Murray, G. H. Stenson, Dana McAfee, D. Lynn and I. K. Harris.

Baltimore & Cumberland.—Bids for the grading of this road will be received until March 31 by the Chief Engineer of the company, Chauncey Ives, at Hancock, Md. Bids will be received for the grading and masonry and tunnel work on the entire line from Cumberland to Hagerstown, Md., 79 miles. This railroad is being projected as an eastern outlet for the West Virginia Central & Pittsburgh, which reaches Cumberland. H. G. Davis is President of both companies.

Baltimore & Drum Point.—The little work that is now going on is confined entirely to the grading on a few miles near Millersville, Md., where a change in the location of the road has been decided upon. J. H. McCreery, of Washington, D. C., who has the contract for completing the line, reports that he proposes to begin laying the rails as soon as the ground is in a condition to carry on this work, and he expects that the entire line will be completed during this year to the southern terminus at Drum Point, 80 miles from Baltimore.

Baltimore & Ohio.—On March 12 the new route through Harper's Ferry, Va., was put in operation, and the old route from Sandy Ferry through the village of Harper's Ferry, about two miles in all, abandoned. The improvements include two miles of double track road, a tunnel 875 ft. in length, under Maryland Heights, and a new iron bridge of nine spans and over 1,000 ft. in length, over the Potomac River. The old line was close alongside the water's edge, while the new line takes considerably higher ground, and is some distance from the river bank.

Bayfield, Lake Shore & Western.—The application for the renewal of the bonds voted in aid of the construction of this line has been acted upon favorably by the town board. This is said to virtually assure the building of the road.

Bellingham Bay & British Columbia.—The company is reported to be considering the advisability of constructing a branch from Everson to Lynden, Wash., a distance of about four miles.

Cammal & Black Forest.—This company was incorporated in Pennsylvania on March 13 to build a road from Cammal, on the Fall Brook Railroad, to County Line Springs, a distance of 15 miles. Robert McCullough, Jersey Shore, Pa., is President.

Centralia & Chester.—Extensions of this line from both Sparta and Centralia are likely to be undertaken this season. Vice-President J. McCutcheon, of Sparta, announces that the right of way has been secured for a line from Sparta to Evansville, 14 miles, and that if the town of Salem accepts the proposition of the company, the extension from Centralia to that town, about 11 miles, will be commenced during the year.

Chelan Falls & Columbia River Valley.—Francis H. Cook, President of the company, organized to build a railroad between Lake Chelan and the Columbia River, is seeking to secure subsidies along the line. The town of Waterville, Wash., has failed to accept the proposition he submitted to connect the town with the Great Northern by a narrow gauge road, but another proposition is now being discussed.

Chicago, Rock Island & Pacific.—It is stated in the Western papers that the company will build a cut-off on its Omaha-Texas line, between Beatrice, Neb., and Herrington, Kan. This will reduce the distance between Omaha and Fort Worth just 100 miles, from 748 to 648 miles. At present the Rock Island runs from Omaha through Lincoln, Jensen and Fairbury to Belleville, thence to McFarland, thence to Herrington and thence to Fort Worth. The new line will be from Beatrice straight across to Herrington or perhaps from Beatrice to Manhattan, Kan.

Chicago, St. Paul, Minneapolis & Omaha.—The statements in regard to this company building a branch from Mitchell to Wheeler, S. D., or the Missouri River, seem to be erroneous. Mr. C. W. Johnson, Chief Engineer of the company, states that there is no intention of constructing any extension this year.

Cincinnati, Union City & Chicago.—A mortgage given to the New York Guaranty & Indemnity Co. by this company, was filed for record in Indiana last week. It is for \$990,000, and was given to secure the issue of bonds for the construction of the road from Huntington to Union City, Ind., about 80 miles. J. C. Fawcett, of Louisville, Ky., is President.

Clearfield & Conemaugh.—This company was chartered at Harrisburg, Pa., March 13, to build a road from a point near Belsena, Clearfield County, to a junction with the Baltimore & Ohio and other roads. The length of the road will be 60 miles. The capital is \$1,350,000. The chief incorporators are J. M. Cooper, of Pittsburgh; Hon. S. J. M. McConnell, who is President of the company, of Harrisburg, Pa.; T. F. Singiser, of Johnson City, Tenn.

Cleveland, Lorain & Wheeling.—Proposals for building the extension of this road into Cleveland, O., were received from nearly 100 contractors. The work includes about 20 miles of new line from near Medina station into Cleveland, O. The name of the successful bidder has not yet been announced by the officers of the company.

Colorado, Oklahoma & Southern.—This company has been incorporated in Oklahoma to build a railroad through the territory and neighboring States. The directors are: D. S. Rose, W. S. Whitinghill, J. S. Hassler, F. H. Morrical, E. W. Pell, D. M. Caldwell and Vernon C. Whitney, of Enid, O. T.; J. W. Graham, Lamar, Col.; and D. M. Stockhouse, of Concordia, Kan.

Duluth & Winnipeg.—Citizens of Fargo are making an effort to have the extension of this line, which it is thought will be built this year, pass through that city and connect with the "Soo" about 20 miles northwest of Valley City, N. D.

Flint & Pere Marquette.—The branch now under construction from Baldwin, Mich., north, is an extension of the Star Lake Branch, about 3 miles long, for the Danaher & Melindy Co., of Ludington, Mich., and is being constructed for logging purposes only. The contractor is J. E. Thick, of Brooks, Mich. The company builds a number of these logging spurs

every year. They are first surveyed with care, and located so as to afford the best facilities for banking or loading the logs; a map and profile is furnished the contractor, and the work is performed without the supervision of an engineer, except for a final inspection when the road is ready for the rails, to see that all conditions have been fairly executed, and the surface is in good shape for track laying. When all the timber has been cut on one spur the track is taken up and removed to a new field.

International & Great Northern.—The extension of the Columbia branch south of Columbia has long been discussed, but the cost of a bridge over the Brazos River has served to delay a decision of the question. The people of Brazoria, Tex., have now agreed to subscribe \$20,000 of the cost of building the bridge, which would not be much greater than the sum mentioned. The company will then have to build six miles of new railroad to reach the town of Brazoria. General Manager T. M. Campbell has announced that he will meet the local committee which has the matter in charge and discuss the question with them.

Lake Superior, Southwestern & Gulf.—The charter for this company in Arkansas was secured last week by L. M. Martin, of Des Moines, Ia., who is the General Manager of the new line. The road has already been chartered in Missouri and other states. The most important work that has been done by the projectors so far is to have a survey made from Little Rock, Ark., north to Aurora, Mo., near the state line. It has been announced that Rosenfeld Brothers, of Omaha, have the contract for this portion of the road. L. S. Steadman is the engineer in charge of the surveys. E. R. Bristol, of Minneapolis, is President.

Maine Shore Line.—Gen. Samuel D. Leavitt, of Eastport, Me., and Judge I. G. Downes, of Calais, Me., were in Boston last week in the interests of this proposed railroad. They say that the road will be built this coming summer. It will start at Eastport, run through East Pembroke to Machias and East Machias, then through Dennisville, Jonesboro, Columbia Falls, Cherryfield, Harrington and Steub to Franklin, a distance of 112 miles.

Marietta & North Georgia.—The foreclosure sale of this road has been postponed for the second time. It was to have occurred at Atlanta, Ga., on March 3, but at the last moment Judge Newman postponed the sale until April 3. Some weeks ago the committee representing the bondholders, the Central Trust Co., of New York, and others, asked for the postponement of the sale, but on March 2, the court decided to grant the request for a postponement for a month.

New Roads.—A. S. Bangs, H. G. Staples and other business men of Augusta, Me., have projected a new railroad connection for Augusta, and have interested other members of the Augusta Board of Trade to discuss the feasibility of building a railroad from Augusta to connect with the Georges Valley Railroad at Union, the object being to give Augusta a shorter and direct opening to Rockland and the seaboard. It would involve the building of only 26 miles of road through a fertile country.

One of the local papers at Butte, Mont., states that work will be commenced this spring on a new railroad to be built from Jocko, on the main line of the Northern Pacific near Missoula, through the Flathead valley and to the coal fields beyond Columbia Falls. A local company will be organized at Butte to start the work. J. A. Talbot and A. J. Davis and others of Butte are interested in coal lands in the section to which the railroad is to be built.

Pennsylvania.—The committee appointed by the citizens of Johnstown, Pa., to secure options on the right of way for a branch of this line through Johnstown, Pa., have been very successful so far and have secured options on the larger portion of the property which will be needed. This branch will be a short one and is projected to give the Pennsylvania a line to the Johnson Steel Works, which has announced that its works will be removed from the city of Johnstown unless it secures increased railroad facilities. The citizens of Johnstown are securing right of way with a view to having this company build through the town and to Moxham to reach the steel works. The company has not yet decided upon any route nor committed itself to building the branch.

Philadelphia & Frankford.—The extension of this road into Frankford, Pa., has been recently resumed under the agreement between the Receivers of the Philadelphia & Reading and the bondholders of the branch road. Nolan & Shields, of Philadelphia, who have the contract for completing the line, put about 300 men at work last week.

Providence, Warren & Bristol.—President Charles P. Clark, of the New York, New Haven & Hartford road, has informed the business men of Providence, R. I., that the proposed extension of the above road, one of the Old Colony lines, from the Fox Point station to the Union passenger station, in Providence, which they have urged, will have to be deferred, because of the general depression in business and the large amount of money which is to be expended for other railroad improvements in Providence.

Santa Fe, Prescott & Phoenix.—Marshall Field, Robert T. Lincoln, N. K. Fairbank, and W. B. Ream, of Chicago, have just completed a tour of inspection over this road in Arizona, in which they are reported to be financially interested. D. B. Robinson, Vice-President of the Atchison, Topeka & Santa Fe, and President of the Santa Fe, Prescott & Phoenix Road, accompanied them.

St. Louis, Chicago & St. Paul.—The extension to East St. Louis, which was partly graded in 1893, will probably be soon under way again and completed into East Louis by the Receivers. The line is about 20 miles long and extends from Alton along the levees on the east side of the Mississippi River to Kinders, near East St. Louis. It is now nearly all graded and the bridges built. The work is not to be done by contract.

St. Louis, Keokuk & Southwestern.—The new line into St. Louis crossing the Missouri River at the Bellefontaine bridge was opened for regular traffic on March 4. This line has been fully described, especially in the *Railroad Gazette* of Dec. 15, 1893. The railroad leaves the old line south of Old Monroe and extends to the Missouri River, about 20 miles, crossing on the Bellefontaine bridge and then running through St. Charles County to the station in the north end of St. Louis. The new line will give the Chicago, Burlington & Quincy trains from the north and west a new entrance into St.

Louis as well as the through trains of the Missouri, Kansas & Texas.

Tivoli Hollow.—This freight railroad in the city of Albany, N. Y., was opened for traffic a week. It was built by an independent company which owns a new terminal warehouse near the river front in Albany, but the railroad has been leased to the New York Central & Hudson River Railroad. It is about 1½ miles long, and extends from the warehouse on the Hudson River, near the tracks of the Delaware & Hudson to a junction of the New York Central & Hudson River road.

Toledo Railroad & Improvement Co.—This company was incorporated in Washington last week, with a capital stock of \$80,000, to build a railroad from Toledo to some point on the Northern Pacific Railroad. The officers of the new company are: F. H. Thorne, President and General Manager; Grant Arnold, Vice-President; G. W. Denny, Secretary, and E. P. Badger, Treasurer.

Toledo Terminal.—This company was incorporated at Columbus, O., this week with a capital stock of \$50,000. The object is to operate a railroad in Lucas County, by steam or other power, from a junction with the Ann Arbor railroad near Manhattan avenue to a point on Cherry street, near the intersection of that street with Woodruff avenue.

Washington & Potomac.—The Washington & Point Lookout Railroad, which is projected to extend through Prince George's, Charles and St. Mary counties in Southern Maryland parallel to the route of the Washington & Potomac, is likely to be consolidated with that company. A bill providing for that action is now pending in the Maryland Legislature. The Washington & Potomac was formerly known as the Southern Maryland, and has about 20 miles of completed road between Mechanicsville and Brandywine, and is projected to extend to Point Lookout.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—The following table gives the earnings and expenses of this system for the month of January, 1894, and for seven months to January 31:

Month of January:	1894.	1893.	Dec.
Average operated mileage	7,480	7,480	
Gross earn.....	\$2,477,509	\$3,051,502	\$373,982
Oper. expen.....	1,973,141	2,406,539	433,982
Net earn.....	\$504,368	\$644,963	\$140,595

Seven months to Jan. 31:

Month of January:	1894.	1893.	Dec.
Average operated mileage	9,344	9,311	
Gross earn.....	\$3,051,623	\$3,727,198	\$675,575
Oper. expen.....	2,124,631	2,916,289	401,658
Net earn.....	\$926,992	\$810,909	\$183,917

Seven months, to Jan. 31:

Month of January:	1894.	1893.	Dec.
Gross earn.....	\$26,814,188	\$30,646,326	\$3,832,138
Oper. expen.....	18,092,197	20,570,901	2,478,707
Net earn.....	\$8,721,991	\$10,075,422	\$1,353,431

The gross earnings of the St. Louis & San Francisco for January were \$574,113, a decrease of \$102,582. The net earnings for the same period were \$122,622, a decrease of \$43,322. The gross earnings for the seven months of the fiscal year were \$4,814,174 in 1894, against \$5,766,955 in 1893. The net earnings were \$1,580,475 in 1894, a decrease of \$596,170.

Baltimore & Eastern Shore.—The reorganization committee of the bondholders of the railroad are negotiating with the Choptank Steamboat Co. for the purchase of the steamboat property. It is the intention to run the steamboat line in connection with the railroad. The principal terminus for freight and passengers will be either at Choptank Bridge or at Easton, where there are excellent wharf facilities. The committee think that the increased facilities which they will be able to offer by operating the steamboat across Chesapeake Bay to Baltimore will divert a large proportion of the Eastern Shore traffic to Baltimore.

Baltimore & Lehigh.—The order for the sale of the Pennsylvania portion of this road which was issued by Judge J. W. Bittenger, of the United States Court, of York, Pa., in February, was revoked on March 4. The order had fixed the date of the sale for March 5. It contemplated only the sale of the portion of the road located in Pennsylvania and did not affect the division of the road in Maryland.

Brookfield & Northern.—In the State Circuit Court at Brookfield, Mo., Judge W. W. Rucker, in response to a petition from the stockholders of the railroad, has appointed Col. M. M. Dako Receiver of the company. No part of the proposed railroad has been built. It was to extend through Missouri from Springfield to the Mississippi River.

Cincinnati, Lebanon & Northern.—The stockholders have recently authorized the changing of the gage of this road from 3 ft. to standard, and President George Hafer, of Cincinnati, is quoted as saying that the change of gage is likely to be carried out during the present year. The present line is about 30 miles long from Cincinnati northwest to Lebanon, O. Plans for making the road a standard gage line have been discussed indefinitely on many former occasions, but no action was ever taken by the stockholders, the chief reason for this being perhaps that there were many schemes proposed for leasing the line to larger roads. Last year the Cincinnati, Jackson & Mackinaw arranged to purchase or lease the line, but negotiations were finally broken off.

Cleveland, Akron & Columbus.—The Norfolk & Western has closed a contract with the Cleveland, Akron & Columbus railroad, whereby the latter secures for a term of years the use of the terminus at Columbus. The terms of the lease are not given. The Norfolk & Western has been transacting the Cleveland, Akron & Columbus business, via Columbus, for some time.

Detroit, Lansing & Northern.—The reorganization plan was issued this week. It provides for the issue of four per cent. 50-year bonds, secured by a mortgage covering the entire system, and \$1,808,394 first preferred stock entitled to six per cent. per annum if earned, and in preference to existing preferred stock, but non-cumulative and without participation in further earnings. The

new mortgage will be for \$6,500,000. There is required for exchange \$5,323,802, which, after reserving \$770,000 to be used only to take up the underlying Ionia & Lansing bonds, by exchange or otherwise, will leave about \$400,000 in the company's treasury, to be used only for improvements and new equipment. For overdue coupons, including those purchased by friends of the road and those maturing up to and including July 1, 1894, new four cent. bonds at par are to be offered in exchange. The Ionia & Lansing first mortgage five per cent. bonds, due in 1890, amounting to \$770,000, are not disturbed, they being secured by an underlying mortgage on the main line. Holders of these bonds have agreed to take new 4 per cent. bonds at par for their coupons of July 1, 1893, and January and July, 1894. The Saginaw Valley & St. Louis bonds and the Saginaw & Grand Rapids stock have no guaranty from the Detroit, Lansing & Northern, but are operated under a contract having six years to run. It is proposed to offer holders of these securities new four per cent. bonds in exchange at par, with 20 per cent. bonus in first preferred stock, provided substantially all agree to the exchange, and provided these roads are conveyed to the Detroit, Lansing & Northern so that they can be included in the new mortgage. Otherwise the roads will be surrendered to the present security holders and the issue of new securities will be reduced pro tanto. Under the plan fixed charges will be reduced from \$354,524 to \$251,445 per annum, although the interest on the new first preferred stock will call for \$108,504 if earned. The net earnings of the entire system for 1893 were \$261,822.

Evansville & Terre Haute.—James Montgomery, of Evansville, Ind., is now operating this road as receiver of the property under the recent decision of the United States Court at Evansville, Ind., which ordered that the property be separated from the Evansville & Terre Haute and operated as a distinct line.

Illinois Central.—The table below gives the income from traffic for seven months to Jan. 31, 1894, as compared with the same period for 1893.

	1894.	1893.	Incl.
Miles operated.....	2,888	2,888	
Gross earnings.....	\$13,626,175	\$11,740,935	\$1,885,220
Oper. expen. & taxes.....	9,020,233	8,468,016	552,217
Net earn.....	\$4,605,942	\$3,272,939	\$1,333,003

The gross receipts from traffic for the month of February, 1894, are estimated at \$1,427,119; the receipts for February, 1893, were \$1,452,194, an estimated decrease of \$25,075.

Louisville, Evansville & St. Louis.—The Peoria, Decatur & Evansville and the above road, which have been operated under one management, are now operated independently and as distinct lines, each company having its own officials. The trains now run into different terminals at Evansville. Heretofore both have used the terminal facilities of the Evansville & Terre Haute at Evansville, but both have erected new stations and have their own yards and switching facilities.

Louisville Southern.—The bondholders of this road who are asked in the new reorganization plan of the Richmond Terminal to accept the consolidated bonds of the new company to be organized to operate the system, object to surrendering their present security for a consolidated bond. They have appointed a committee to request that they be given in exchange for their present first mortgage bonds new bonds to be a first mortgage on the Louisville Southern road.

Louisville Terminal.—This company has been placed in the hands of a Receiver by Judge Barr, of the United States Court at Louisville, Herbert V. Harris being named as the Receiver. The application for a Receiver was made by the Farmers' Loan & Trust Co., of New York, trustee of the first mortgage bonds. The company defaulted payment on the January interest. The terminal is a belt line at Louisville, with about three miles of track at South Louisville completed in 1892.

Missouri Pacific.—The annual report for the year ending Dec. 31 gives the following results of operations for the last two years:

	1893.	1892.	Incl. or dec.
Gross earn.....	\$24,018,338	\$26,344,787	\$2,326,449
Oper. expen.....	18,257,167	19,238,187	D. \$81,019
Net earn.....	\$5,761,170	\$7,106,600	D. \$1,315,430
Other income.....	1,543,711	683,797	L. \$846,912
Total earn.....	\$7,304,881	\$7,803,397	D. \$985,518
Fixed charges.....	7,186,076	6,999,582	L. 196,493
Surplus.....		\$108,805	\$803,815 D. \$695,011

The Missouri Pacific net earnings increased in January, March and May and December and decreased in the other months. The greatest net decrease was in August, \$538,285, and December the net earnings increased \$41,837. The floating debt of the Missouri Pacific is placed at \$6,779,302, with cash assets valued at \$4,464,954, and the net floating debt is calculated at \$2,220,620, against which are many securities. The Iron Mountain road has a net floating debt of \$3,980,795.

New York Central & Hudson River.—The gross earnings of this road for the month of February, 1894, were \$3,003,900, against \$3,285,051 for the same period of 1893, being a decrease of \$281,061.

New York, New Haven & Hartford.—The meetings of the directors of the company are now held in New Haven, Conn., instead of in New York City, the first meeting at New Haven having been held in the new office building at New Haven last week. There are two vacancies in the board of directors, but no action was taken at this meeting to elect new directors. President Clark, made statement in regard to the present condition of the property, saying in part, the gross earnings of the company were not affected by the depression of business until August. Since that time they have fallen off nearly 8 per cent. as compared with the corresponding months of the previous year. The net results have been more satisfactory during the last two or three months by reason of economies in operating. Wages have not been reduced. Still it cannot be said that we are yet earning the full dividend. "It is, however, fully justified by the large surplus of earnings in previous years, which have not been divided. The stock of the company is held in small lots, and largely by people of moderate means, and the directors desire to maintain the usual rate unless clearly their duty and for the permanent interest of the property to change it. The operating accounts of the Old Colony Railroad have been consolidated with ours since July 1. The unusual expenses attending any lease of this importance have necessarily decreased the net earnings of the joint property, while the time has not been sufficient to yield the benefits which are expected from the consolidation of interests."

New York & New England.—The annual meeting of the company called for March 13 has been adjourned until March 21, as no list of directors to be voted for had been prepared by the Reorganization Committee, which holds the proxies. President McLeod's report showed the following financial situation for the year ended Dec. 31:

	1893.	1892.	Inc. or dec.
Gross earnings.....	\$6,019,219	\$6,220,494	D. \$201,285
Oper. expenses.....	4,467,974	4,412,147	I. 45,827
Net earnings.....	\$1,561,235	\$1,808,347	D. \$247,112
Total income.....	1,566,586	1,813,701	D. 247,115
Fixed charges.....	1,893,935	1,874,132	I. 19,853
Deficit.....	\$327,399	\$60,431	I. \$266,968
Renewals, etc.....	143,752	.....	I. 143,752
Total deficit.....	\$471,151	\$60,431	I. \$410,720

The freight traffic was reported to be up to the average during the first half of the year, although rates were badly cut by all roads leading from Boston. Despite extreme competition gross freight returns for the first six months aggregated \$1,883,780, an increase of \$171,810 over the same period of the previous year. Passenger earnings in the same time aggregated \$965,007, a decrease of \$32,533. In the last half of the year the total tonnage of the road fell off 20 per cent. on account of the general business depression, and high-class freight fell off correspondingly, increasing the percentage of operating expenses. The depression was felt more severely in the local freight traffic than in the through business, which declined only 12 per cent.

North Galveston, Houston & Kansas City.—The foreclosure sale of this road which was to have taken place at Galveston, Tex., on March 6, was postponed because the highest bid offered for the property was only \$28,000, the lowest amount named in the decree of sale being \$50,000.

Northwestern Coal Railway.—This company has purchased the property and franchise of the West Superior Belt Line Railway for \$250,000 and has formally assumed possession.

Omaha Bridge & Terminal Co.—The company has made a contract with the Missouri Pacific by which all trains crossing the Missouri River on the new bridge will have the use of the Missouri tracks to South Omaha, where the packing houses are located. This is a very important agreement and completely destroys the monopoly of the Union Pacific bridge and tracks to South Omaha.

Pittsburgh, Akron & Western.—Receiver W. A. Lynch, of Akron, O., has received the consent of the bondholders and the courts authorizing him to issue Receivers' certificates to pay off the indebtedness for construction work and to improve the road. This will cause the withdrawal of the suit now pending for the foreclosure of the mortgages on the road. The receiver proposes to issue certificates aggregating \$400,000. The liens amount to about \$300,000. This will leave \$100,000 to provide for other indebtedness. The plan outlined also provides that the Receiver will be given permission to operate the road for a few years.

Souix City Rapid Transit.—A decree of foreclosure has been granted against the Rapid Transit Company, operating four miles of elevated street railroad in Sioux City, Ia., in favor of the Manhattan Trust Co., trustees for \$250,000 of bonds.

St. Lawrence & Adirondack.—The New York Central & Hudson River road assumed control of the St. Lawrence & Adirondack, running between Coteau, Que., or from the St. Lawrence River south to Malone, N. Y., 40 miles. At the latter town the road connects with the Mohawk & Malone. Both these roads were built by Seward Webb, but the Central Vermont has been operating the St. Lawrence & Adirondack since it was completed.

Toledo, Peoria & Western.—The Pennsylvania has proposed to the Chicago, Burlington & Quincy a plan for the joint operation of this road by the two companies. It provides for the purchase by the latter company of one-half of the stock and bonds of Toledo, Peoria & Western at the same price the Pennsylvania paid for them.

West Jersey.—The annual report for the year ending Dec. 31 was issued last week and shows gross earnings of \$1,688,046, a decrease of \$58,274; expenses, \$1,226,838, an increase of \$7,536; net earnings, \$401,208; decrease, \$65,811. During the year 3,026,527 passengers were carried, equivalent to 66,166,606 carried one mile. Increase of individual passengers, 44,654, or 1.5 per cent. Average distance traveled by each passenger, 21.50 miles. The freight transported aggregated 834,651 tons, an increase of 33,190, or 4.14 per cent. tons. Each ton was carried on an average of 29 miles. During 1893 1,346 tons of new rails and 90,551 cross ties were used for renewals and new tracks.

TRAFFIC.

Traffic Notes.

A meeting of the Trans-Missouri Committee of the Western Passenger Association has been called for March 20 to take action on the withdrawal of the Atchison, Topeka & Santa Fe.

The Big Four has completed arrangements with the Chicago & Eastern Illinois for the use of its tracks between Danville and Chicago for a through train service between St. Louis and Chicago.

The Chicago & Northwestern has put on a new fast mail and passenger service between Chicago and Lake Superior points. The train leaves Chicago at 3 a. m., and reaches Ashland, 452 miles, at 5:45 p. m.

The Northern Michigan Transportation Co. and the Seymour Transportation Co., running vessels on Lake Michigan, have become tired of fighting and have consolidated under the name of the Northern Michigan Transportation Co.

The roads in the Central Traffic Association have reduced rates on iron and steel articles, west bound, about 25 per cent., the rate from Pittsburgh to Chicago being reduced from 15 cents to 11 cents, and to East St. Louis from 18½ cents to 13 cents. The rate from Cleveland to Chicago is 8 cents.

It is announced in San Francisco that the Pacific Mail Steamship Co. has raised its freight rates to Panama and other ports in that direction, indicating, it is supposed, that the officers of the company believe that the opposition line, the North American Navigation Co., will not be able to longer compete.

According to a statement by Mr. Moller, in an address

at Galveston recently, the track and wharf facilities at that city are sufficient for handling 250,000 bales of cotton a month. The tracks devoted to this traffic will accommodate 2,000 cars. The compresses have warehouse room for 125,000 bales and the wharf capacity allotted for cotton ships amounts to 90,000 bales. About 10,000 bales of cotton can be unloaded from the cars at the wharves in one day.

The secretaries of the Nebraska State Board of Transportation, who have been investigating the "transfer switch law" passed by the last Legislature, have ordered the Burlington and the Union Pacific to construct a joint connecting track at Schuyler, and the Fremont, Elkhorn & Missouri Valley and the Sioux City Short Line to build one at O'Neill. These two were selected from over 100 applications to make tests. The railroads will take the matter to the Supreme Court.

Vessels loaded with 8½ million bushels of grain are ready to sail from Chicago to Buffalo, and the Straits of Mackinaw are said to be passable, but the boats will not start until April 1, because insurance does not begin until that date. It is reported from Buffalo that the package freight steamers will not sail before April 10. Conferences have been held between the traffic officers of the lake lines and of the connecting railroads, at which an attempt was made to agree upon freight tariffs for the ensuing season, but thus far nothing has been decided and it is said that the boat line controlled by the Delaware, Lackawanna & Western has already contracted for large quantities of package freight at less than the normal tariff rates.

A suit for demurrage on freight cars at Cleveland has been decided against the railroad. In December, 1892, the J. Seiberling Company refused to pay demurrage on carload of lumber which was detained six or eight days pending an inquiry as to the correctness of the billing and as to whether the lumber actually belonged to the Seiberling company. The consignee got possession of the lumber by a replevin. The Common Pleas Court holds that it is for the jury to determine, under the circumstances of each case, what constitutes a reasonable time for unloading, and what is a reasonable charge for detention, without reference to the car service rules. It does not appear whether it was the time limit or the rate per day that the jury regarded as unreasonable.

A case has been decided in the United States Court at Macon, Ga., which will be of interest to the shippers who are complaining of the conditions in the new freight classification of the Trunk Lines. Some peaches shipped from Fort Valley, Ga., to New York, were lost by being smashed up in a derailment and the railroad company would pay only \$300 a car for them, according to the limitation in the bill of lading. Judge Speer affirms the report of the master, holding that this stipulation in the bill of lading was unreasonable and that the road must pay for the peaches at a fair valuation. The gist of the decision is that although the consignor might have shipped without the \$300 stipulation, at tariff rates, these rates (which would have deprived the shipper of through bill of lading) were practically prohibitory. It is held that the shipper practically refused assent to the agreement, "but his hand was in the lion's mouth and therefore he was compelled to sign" or lose his peaches. The rate, \$175 a car to New York, is held to have been a fair compensation for transportation and all the risks taken by the road.

Chicago Traffic Matters.

CHICAGO, March 14, 1894.

But little substantial progress was made at the meeting of the managers of the Central Traffic Association lines at their meeting last week. An agreement was reached between Chicago-New York lines to not pay more than \$3 commission on first class tickets after March 9. Similar agreements have frequently been made heretofore. A general discussion of the freight situation was had, but as all the lines claimed to be maintaining rates no action was had. The details of the proposed percentage readjustment from Chicago, Peoria, Cincinnati, Indianapolis, Louisville, etc., eastbound, was referred to the freight traffic officials with instructions to report at the meeting of the Joint Committee, which is to be held in New York to-morrow. The passenger representatives were also instructed to make further report concerning the proposed agreement on eastbound business at the meeting this week. No action was taken concerning changes in the official classification recommended at the last New York conference.

Another chapter has been added to the history of the pass agreement. The Receivers of the Atchison sent a part letter to Chairman Midgley in which they demanded a verification of the charges made against that road and the names of the persons making them. To this the chairman replied that the meeting exercised its undoubted right to deliberate and resolve, and that the chairman announced its conclusions as in duty bound; that his duty then ceased, and he declined to trouble himself further with the matter.

During the World's Fair period a dispute arose between the eastern and western lines as to the proportions to be received by the latter on immigrant business. The former insisted that the divisions should be accepted on the prevailing excursion rate basis, to which the western lines demurred, demanding proportions based on the regular immigrant rate. Chairman Caldwell, of the Western Passenger Association, has now ruled that on business to Aug. 31 the basis should be the prevailing excursion rates, but on business subsequent to that time full proportions of the regular tariff should be demanded.

The Alton and the Illinois Central are now engaged in a passenger rate war which was precipitated by the action of the latter in selling "land-seekers" excursion tickets. The Alton has announced a "labor rate" of \$10 from Memphis to Chicago for parties of three traveling on one ticket, and has also authorized the Northwestern lines to make half rates on round trip tickets to all points in Iowa, Wisconsin and South Dakota to all points in the South covered by the Illinois Central excursion rates.

The proposition of the Western passenger agents to discontinue the issue of 2,000-mile tickets at \$50, with a rebate of \$10, and substitute a 1,000-mile ticket good or bearer for \$25, has brought a protest from the National Travelers' Association coupled with a threat that if the change is made action will be taken under the Illinois law to have the Association dissolved. The traveling men want a 5,000-mile interchangeable ticket, and claim that the proposed action of the roads is simply a pretext to raise the rate from 2 cents to 2½ cents.

At a meeting of the Western Freight Association last week rules similar to those adopted by the Central Traffic Association were adopted to govern the use of the new uniform classification when it shall have been adopted by all the associations. A large number of local

rates were tinkered and an equally large number of applications were referred to the chairman. A committee was appointed to represent the association lines before the Interstate Commerce Commission this week in Washington on the subject of a new form of joint tariffs.

The Chicago Committee were called together last week to investigate the reports that the 20-cent grain rate to New York was being cut to 17½ cents. All the members energetically denied having done so.

The Local Passenger Association has investigated charges against the Burlington and the Wisconsin Central of having held a train beyond schedule time for a party without having collected extra fare, and has dismissed the complaints on the ground that in the new agreement the clause in the old agreement prohibiting such action was intentionally omitted.

Western Passenger Association lines will meet the action of the Kansas City, Ft. Scott & Memphis in issuing 2000-mile mileage books at \$50, with a rebate of \$10 for the covers.

Western lines have agreed that summer tourist rates shall be the same as last year, the round-trip rate being figured on a basis of 80 per cent. of the double locals.

The Western Passenger Association has decided that it is proper to transport insane soldiers at the same rate applicable for Government troops.

The eastbound freight movement last week showed large gains, and gives color to the rumors that the contracting agents of some of the lines are "out for the stuff" regardless of agreed rates.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines, for the week ending March 10 amounted to 80,955 tons, against 67,940 tons during the preceding week, an increase of 19,015 tons, and against 83,758 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	Wk to Mar. 10,		Wk to Mch. 3.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central.....	8,461	9.7	6,699	9.8
Wabash.....	10,114	11.6	6,861	10.1
Lake Shore & Michigan South.....	14,682	16.8	13,084	19.3
Pitts., Ft. Wayne & Chicago.....	6,377	7.3	6,893	10.2
Pitts., Cin., Chicago & St. Louis.....	8,549	9.8	6,900	10.2
Baltimore & Ohio.....	8,957	10.3	5,108	7.5
Chicago & Grand Trunk.....	8,999	10.4	5,728	8.4
New York, Chic. & St. Louis.....	10,339	11.9	6,163	9.1
Chicago & Erie.....	7,873	9.2	5,085	11.9
C. C. & St. Louis.....	2,604	3.0	2,412	3.5
Totals.....	86,955	100.0	67,910	100.0

Of the above shipments 6,290 tons were flour, 50,961 tons grain and mill-stuff, 10,431 tons cured meats, 10,459 tons dressed beef, 1,152 tons butter, 1,667 tons hides and 3,467 tons lumber. The three Vanderbilt lines carried 47.4 per cent., the two Pennsylvania lines 17.1 per cent.

(Other Chicago traffic news will be found on page 197.)

The Southern Railway and Steamship Association.

The notice of withdrawal from this association, sent by the Louisville & Nashville on Feb. 13, has been followed by similar notices from the Illinois Central, and, according to the newspapers, from the Mobile & Ohio. The Louisville & Nashville last week made reductions of from 5 to 10 cents per 100 lbs. on grain and other important commodities from Memphis and all northern gateways to the principal points south of the Memphis & Charleston and east of the Mobile & Ohio.

A meeting was held in New York on Tuesday of this week to consider the rate troubles which caused these withdrawals. It does not appear that any progress was made in the meeting, but a committee of five was appointed to examine into the controversy and report a basis for settlement. The committee was composed of H. S. Haines, H. M. Comer, Samuel Spencer, Harry Walters and John C. Winder. Some further details of the controversy between the Louisville & Nashville and its competitors will be found on another page.

The Trans-Continental Passenger Rate War.

No visible progress has been made during the past week in arriving at a settlement of the matters in dispute between the Atchison, Topeka & Santa Fe and the Southern Pacific. The presidents of the Chicago-Missouri River lines united in a request to the belligerents that they submit their dispute to arbitration. The Southern Pacific agreed, provided rates were first restored and either side trips be allowed by both roads or no side trips at all be allowed pending arbitration. The Santa Fe declined to accept this proposition, but proposed that rates be restored and negotiations be taken up where they were broken off last fall. This is taken as an intimation by the Santa Fe that it proposes to fight it out on the present line and that the mediation of the other lines is not desired. The impression is gaining ground that the outcome may yet be a strong offensive and defensive alliance between the Southern Pacific and the Santa Fe, with the possible addition of the Rio Grande, to the exclusion of the Union Pacific and other northern lines. The Santa Fe claims to be filling its trains and to be making more net revenue than before the reductions. Its reductions from Texas points have also had the effect of largely increasing its traffic from business which under normal conditions it would not receive. Reductions have also been made from Chicago to El Paso and other Texas points for the purpose of equalizing through rates, which have had the effect of bringing about reductions by the Missouri, Kansas & Texas.

The Santa Fe has not only withdrawn from the Western Passenger Association agreement, but also from the local associations and the immigrant agreement, which still further complicates the situation.

The last hope of preserving the Chicago-Missouri River rates vanished on Monday when the Santa Fe gave notice that it would put into effect on March 15 a rate of \$10 from Chicago to Kansas City. This was done because it had obtained proof that scalpers were selling tickets from Chicago to San Francisco, reading over the Chicago & Northwestern and Union Pacific, at \$30 one way, a cut of \$2.50, and \$54 round trip. Similar tickets are also being offered by brokers in San Francisco at a cut of \$8. The Northwestern disclaims knowledge of this and throws the entire blame on the Union Pacific. Why the Union Pacific should be manipulating the rates is a mystery, unless, as has been suggested, it wishes to make itself a factor in the present fight, thinking it will stand a better chance of recognition in case the Southern Pacific and Santa Fe come to an agreement. These reductions will be met by all the other roads, with the effect to thoroughly demoralize all remaining rates between the Mississippi River and the Pacific Coast.